

WSM

WORKSHOP MANUAL
COMPACT TRACK
LOADER

SVL65-2

Kubota

TO THE READER

This workshop manual provides safety information for service activity, general information such as specifications and dimensions of the machine, mechanisms and structure descriptions of the machine, and service procedures.

Safety

This section contains safety service descriptions and safety label information.

General

This section contains general instructions, tightening torques, general machine information and special tools.

Maintenance

This section contains information for the recommended oil and general maintenance procedures.

Each section basically consists of mechanism and servicing.

Mechanism

Mechanism part contains information and explanations for the structure, functions, and specifications of the machine or component parts. This part should be comprehended before proceeding with troubleshooting, disassembling, assembling, and servicing works.

Servicing

Servicing part contains information and procedures for maintenance, troubleshooting and repair works. The reader should follow these instructions in order to satisfy any servicing work safely, correctly and quickly.

In this WSM, service specifications and service limits are defined as followings.

Service specifications:

Specification which corresponds to new machine's ex-factory. It is based on quality standard, drawings, or actual measurements conducted by Kubota. This value is used to determine whether there is a problem with the machine in the event of a troubleshooting. However, it is necessary to consider degradation due to wear, based on the operating time of the machine, application or maintenance condition.

Service limits:

Service limit is a value corresponding to the recommended performance limit by taking long term-use wear into account. When the service limit is reached, the machine is required to have proper repair, overhaul or replacement in order to keep safe and adequate performance.

All of the illustrations, photographs, specifications, and other information in this manual were created based on the latest model at the time of publication.

The parts names used in this manual are unified into names representing the functions of the parts. Therefore, it does not necessarily correspond to the names used in other materials (parts list, operators manual etc.) and the name on the label / identification plates on the product.

Kubota reserves the right to change all information at any time without notice.

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SUPPLEMENTARY INFORMATION

For the engine servicing information, please refer to the following engine WSM, DM, or DPF handling manual.

■ NOTE

- The PDF No. may be changed by revision.

Manuals related to the engine (V2607-CR-TE4-CTL, V2607-CR-TE4-CTL-Q)

Manuals	Title	PDF No.
WSM	V2607-CR-E4B V2607-CR-TE4B V2607-CR-TIE4B V3307-CR-TE4B V3307-CR-TIE4B	9Y111-06747 (English) 9Y111-11037 (French)
DM	SVL65-2 (V2607-CR-TE4-CTL, V2607-CR-TE4-CTL-Q)	RY910-26290 (English)
DPF handling manual	DIESEL PARTICULATE FILTER HANDLING MANUAL (FOR COMPACT TRACK LOAD- ER)	RY910-22220 (English)

REVISION HISTORY

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ABBREVIATIONS

Abbreviations	Definitions	Abbreviations	Definitions
A/C	Air Conditioning	ISO	International Standards Organization
AC	Alternating Current	J/C	Joint Connector
ACC	Accessory	JIS	Japanese Industry Standard
AFS	Air Flow Sensor	LCD	Liquid Crystal Display
AI	Auto Idle	LED	Light Emitting Diode
API	American Petroleum Institute	LH	Left Hand side
Approx.	Approximately	LSD	Limited Slip Differential
AS	Auto Stop	MAX	Maximum
ASSY.	Assembly	MIL	Military Standards
ASTM	American Society for Testing and Materials	MIN	Minimum
AUX	Auxiliary	NC	Normally Closed
C/V	Control Valve	NO	Normally Opened
CAB	Cabin	OD	Outer Diameter
CAN	Controller Area Network	P/V	Pilot Valve
CCV	Closed Crankcase Ventilation	P/L	Pressure Limiter
CECE	Committee for European Construction Equip- ment	RH	Right Hand side
CNP	Canopy	RMS	Root Mean Square
CRS	Common Rail System	ROPS	Roll Over Protective Structure
DIN	Deutsches Institut für Normung (German In- stitute for Standards)	SAE	Society of Automotive Engineers
DOC	Diesel Oxidation Catalysts	SBF	Slow Blow Fuse
DM	Diagnostic Manual	SCV	Suction Control Valve
DPF	Diesel Particulate Filters	SI	Système Internationale (International system of units)
ECU	Electronic Control Unit	S/J	Swivel Joint
EGR	Exhaust Gas Recirculation	SOL	Solenoid
EN	Europäische Norm (European standard)	spec.	Specification
Eng	Engine	SW	Switch
FOPS	Falling Object Protective Structure	TEMP.	Temperature
GND	Ground	TPSS	Two Pattern Selection System
HST	Hydraulic Static Transmission	WSM	Work Shop Manual
IAT	Intake Air Temperature	W/H	Wire Harness
ID	Inner Diameter		

1. INFORMATION

SAFETY FIRST

Read the safety instructions in the manual and on the safety labels very carefully to avoid personal injury. The safety symbols, precautions and safety labels offer instructions regarding safety regulations for machine operation. It is essential that you read and follow them.



DANGER

- Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

- Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

- Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

■ IMPORTANT

- Indicates that equipment or property damage could result if instructions are not followed.

■ NOTE

- Gives helpful information.

1. Safety first

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you try to repair or use this unit.



DANGER

- Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



WARNING

- Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

- Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

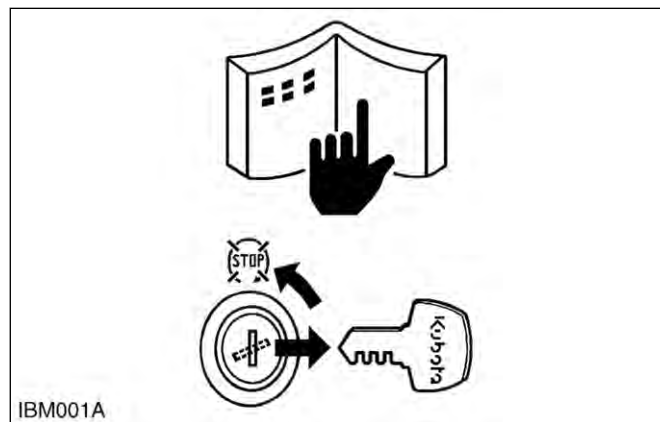
■ IMPORTANT

- Indicates that equipment or property damage could result if instructions are not followed.

■ NOTE

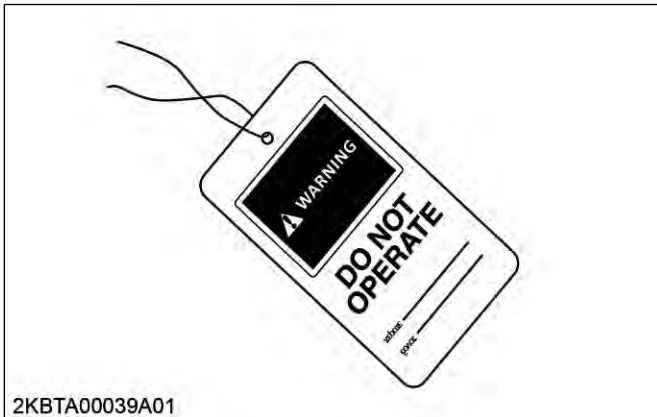
- Gives helpful information.

1.1 Working precautions



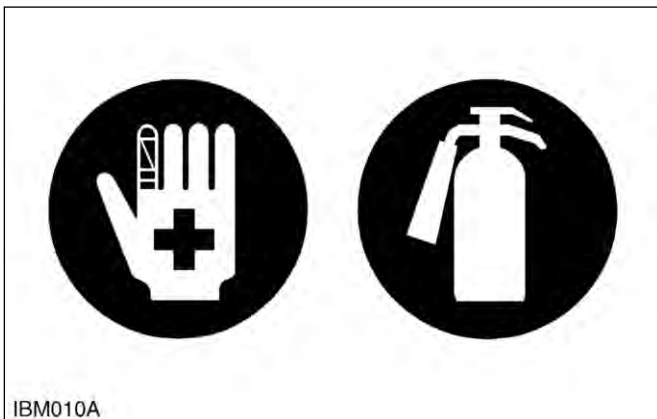
- Understand all safety instructions and safety labels in this manual.
- Park the machine on a stable and level ground then lower the attachment to check the machine safely.

- Stop the engine and remove the key when leaving the operator's seat for cleaning, maintenance, and servicing.



- Hang a DO NOT OPERATE tag near the operator's seat.
- Do not use worn or cracked tools. Use tools in a proper way with enough strength.
- In regards to the facility which is used in the workshop, follow each safety instruction.

1.2 Preparing for emergencies

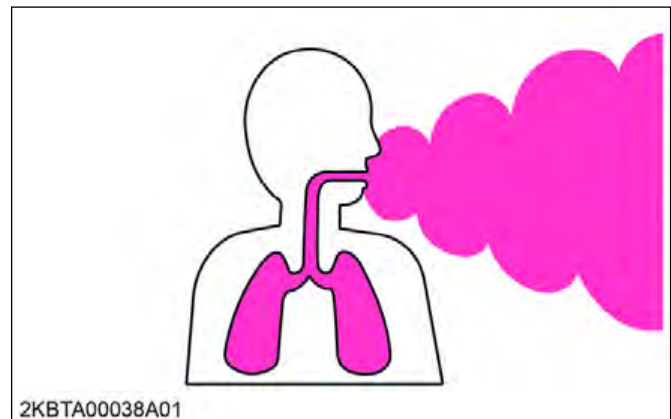


- Keep a first aid kit and fire extinguisher ready at all times.
- Keep emergency numbers near your telephone at all times.

1.3 Working cautions



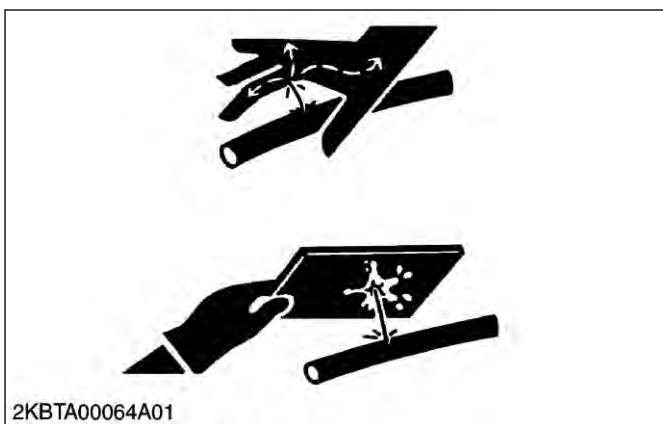
- Wear a uniform suited for service working. Do not wear loose clothes as they could get caught on the control lever.
- Wear the proper protective equipment when checking the machine. For example helmet, eye protector and protective shoes.
- Do not check the machine after you have consumed alcohol or drugs or when you are tired.



- Park the machine on a stable and level ground. Keep the machine away from obstacles and hazardous materials.
- Make sure to ventilate the work area in cases of working indoors.
- Do not allow third parties to come near the machine.
- Keep the machine clean. Remove dirt, debris, and oil attached to the machine.



- Make sure you have the support of the 3 points with both hands holding the handle and one foot at the step when getting on and off the machine.

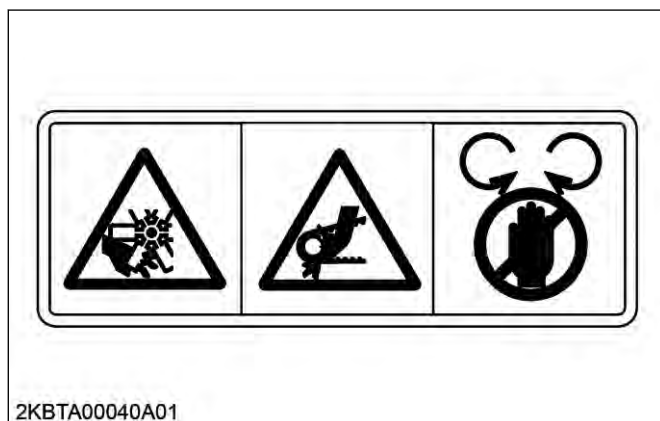


- Confirm the coolant temperature and release pressure when opening the radiator cap.
- Release residual pressure in the hydraulic circuit before removing the hydraulic components.
- Pay attention when releasing pressure in hydraulic circuit, the machine or attachment might move unexpectedly.
- When working under the machine, make sure the machine does not move back and forth.
- When working under the machine, provide secure support for the machine.
- When using a garage jack, always use with a rigid rack to prevent the machine from falling.

1.4 Starting the machine safely

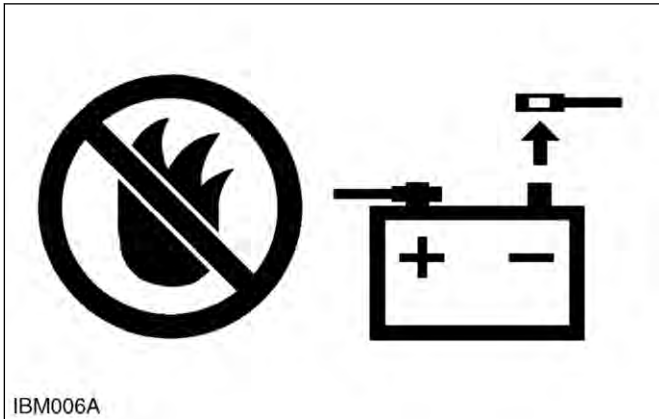


- Do not do the following work when starting the engine.
 - Short across starter terminals.
 - Bypass the safety start switch.
- Confirm if it is safe around the machine from the operator's seat before starting the engine.
- Do not start the engine unless seating in the operator's seat.
- Make sure that the pilot levers are in neutral before starting the engine.



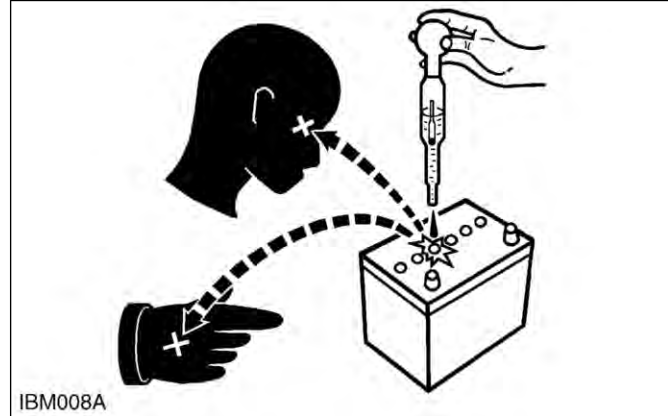
- Lock the covers before starting the machine.
- Keep away from rotating and moving objects.
- Keep tools and waste cloth away from rotating and moving objects.

1.5 Preventing fires



- Keep fire (welding sparks, grinding sparks, cigarettes) away from the fuel.
- Wipe the fuel off when spilled.
- Keep fire (welding sparks, grinding sparks, cigarettes) away from the battery. The battery produces oxygen and hydrogen gas that are flammable.
- Make sure to disconnect the negative (-) terminal first when disconnecting the battery cable.
- Make sure to connect the positive (+) terminal first when connecting the battery cable.
- Follow notes on handling diesel particulate filter (DPF).
- Do not make a short-circuit.
- Do not splash the hydraulic oil on the exhaust components.

1.6 Preventing acid burns



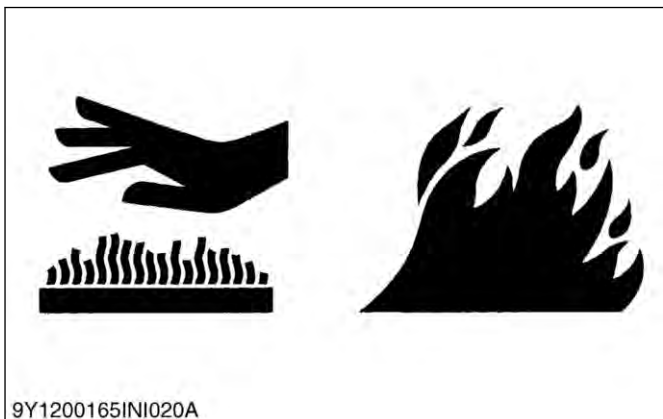
- Keep the electrolyte away from your eyes, hands, and clothes. Sulfuric acid in the battery electrolyte is poisonous: it can cause blindness and strong enough to burn your skin and clothing. If you spill electrolyte on yourself, clean yourself with water and get a medical aid immediately.

1.7 Avoiding high pressure fluid

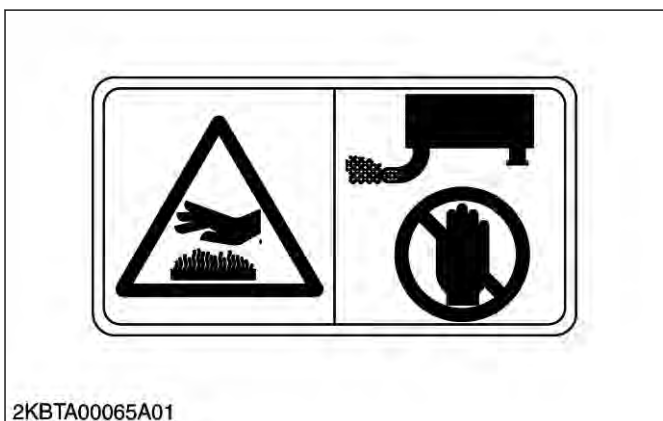


- Keep away from high pressure fluids bursting from a hose or pipe. The fluid can penetrate your skin and cause serious injuries.
- Get a medical aid immediately if the accident occurs.

1.8 Avoiding hot exhaust

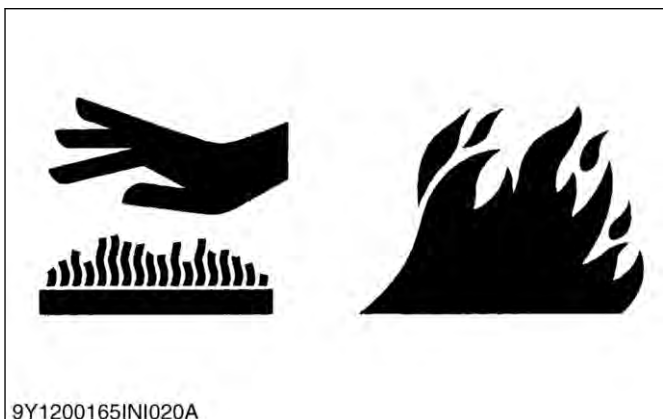


- Avoid skin exposure and contact with hot exhaust gas or components.
- Exhaust gas and components are extremely hot during operation.



- Do not work immediately after stopping the engine. The engine, muffler, radiator, and hydraulic components are extremely hot.
- Do not remove caps and plugs soon after stopping the engine. The temperature and pressure of the coolant, hydraulic oil, and fuel are still high.

1.9 Cleaning exhaust filter



- Avoid skin exposure and contact with hot exhaust gas or components. Exhaust gas and components are extremely hot during regeneration of diesel particulate filter (DPF).

2. Safety labels

2.1 Safety labels placement

Read the safety instructions on safety label carefully to avoid personal injury.

(1) Part No. V0511-5735-2



1BCAAAAAP079E

(2) Part No. V0511-5740-2



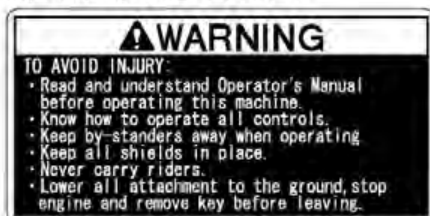
1BCAAAAAP071E

(3) Part No. V0511-5772-1



1BCAAAAAP221E

(4) Part No. V0211-5731-1



1WAKA00064A01

(5) Part No. V1311-5771-3 [High-Flow model only]



1BCAAAAAP306A

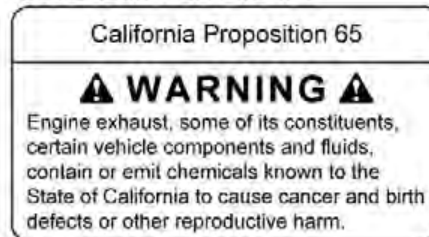
1WAKA00047A01enUS

(6) Part No. V0631-5732-1

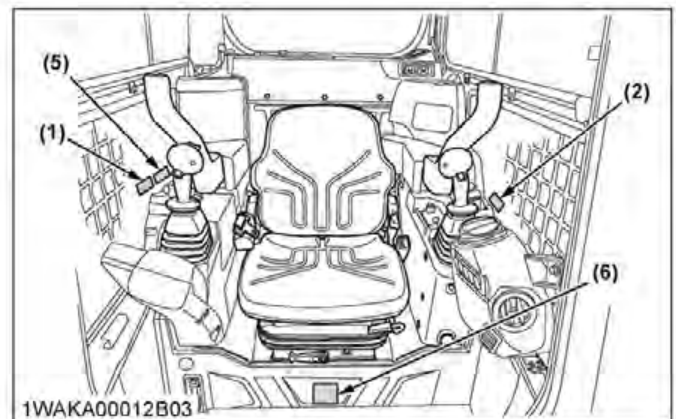


1BCAAAAAP307A

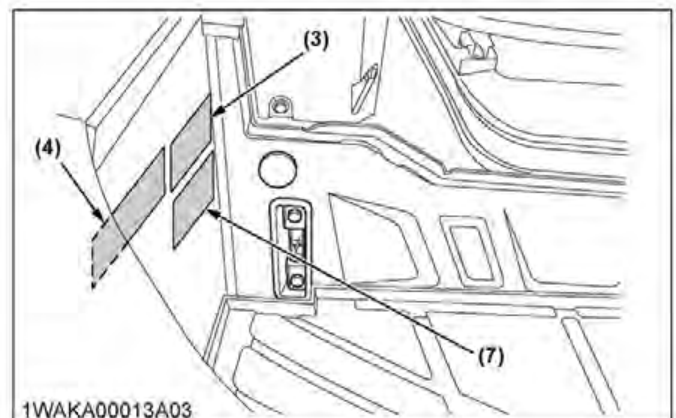
(7) Part No. V1311-5749-1



1BBBD00148A01

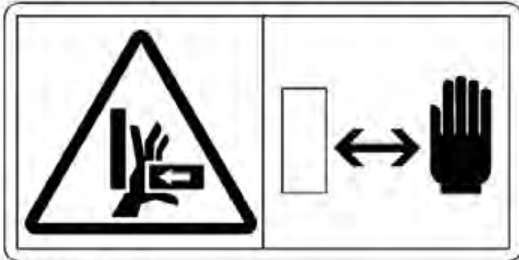


1WAKA00012B03

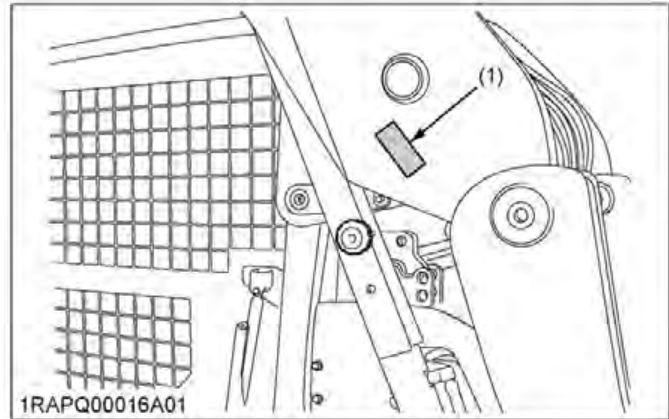


1WAKA00013A03

- (1) Part No. V1311-5734-1 [Both sides]
Do not allow hands within the working range.



1BCAAAAAP308A

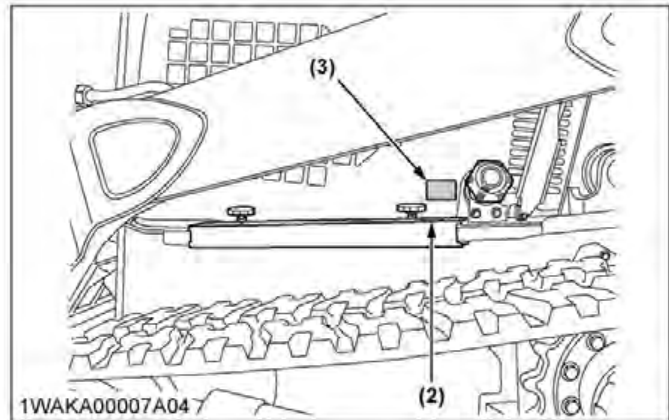


1RAPQ00016A01

- (2) Part No. V0511-5741-2



1BCAAAAAP078E

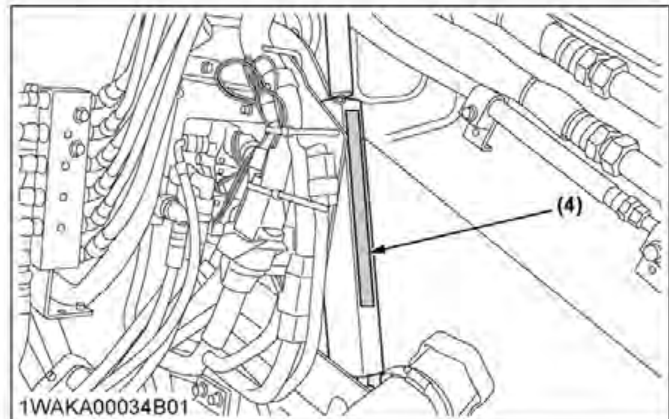


1WAKA00007A04

- (3) Part No. RD358-5736-1
Diesel fuel only No fire



1BAAGAAP1810



1WAKA00034B01

- (4) Part No. V0511-5743-1



1BCAAAAAP137E

1WAKA00048A01enUS

(1) Part No. V0621-5748-1

Do not touch hot parts such as exhaust etc.



1BCAAAAAP072E

(2) Part No. V0511-5739-1

Keep away from fan and fan belt.



1BCAAAAAP073E

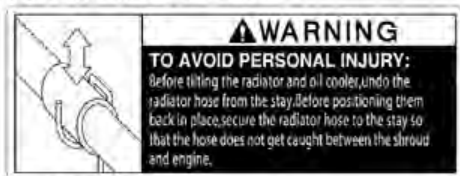
(3) Part No. V0521-5750-1

Do not open the caps when the radiator is hot.



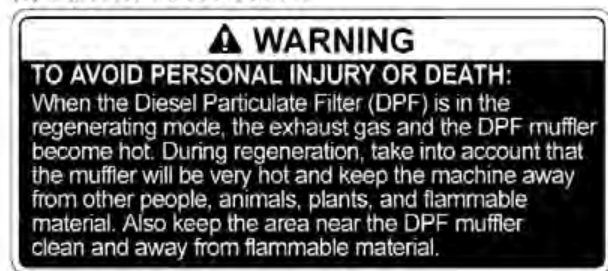
1BAABAGAP2650

(4) Part No. V0521-5744-1



1BCAAAAAP378A

(5) Part No. TC660-9861-1

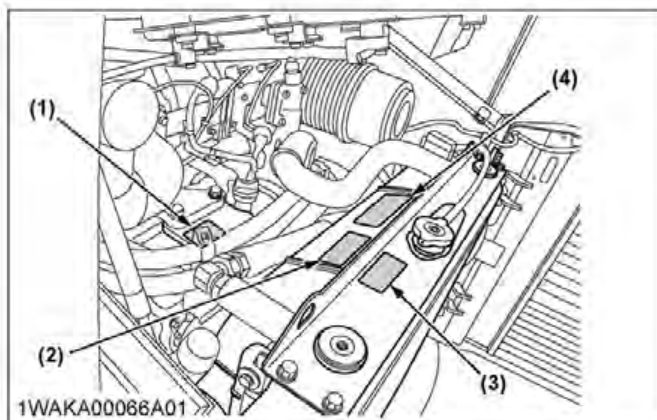


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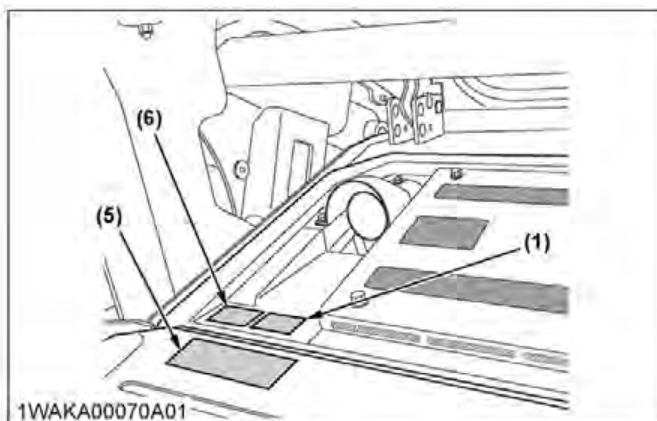
(6) Part No. V1311-5763-1



1BCAAAAAP315A



1WAKA00066A01



1WAKA00070A01

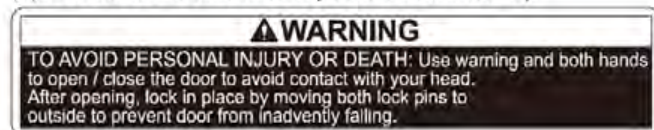
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(1) Part No. V0521-5773-1

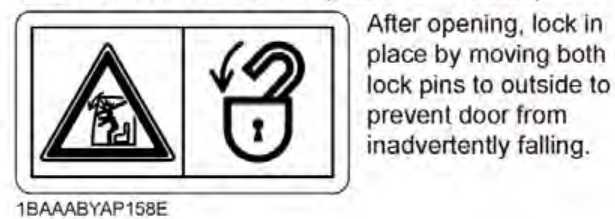
Do not allow any persons on the bucket.



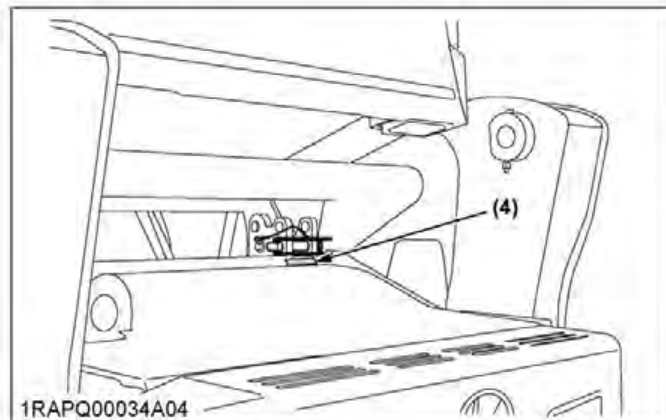
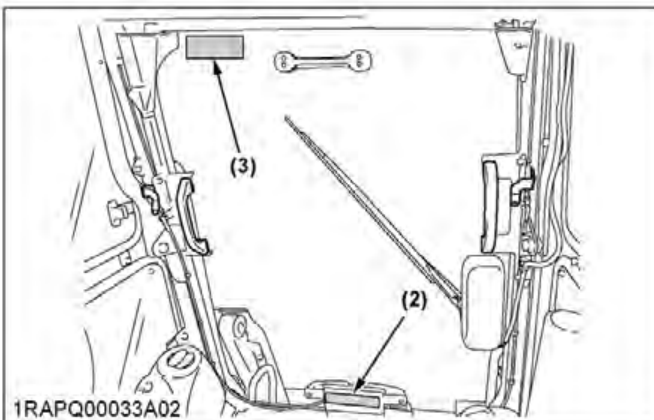
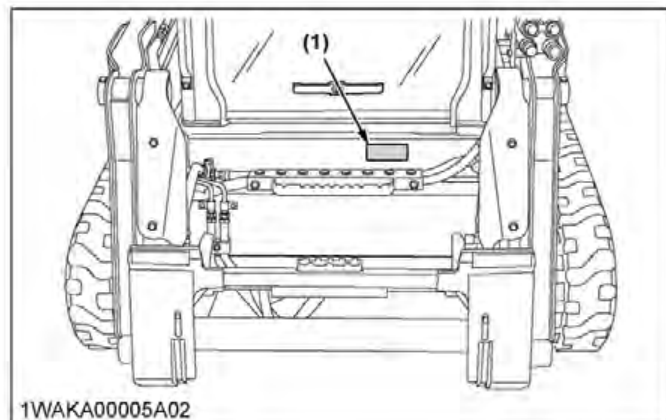
(2) Part No. V1311-5745-2 (Closed cab model)



(3) Part No. RB419-5793-2 (Closed cab model)



(4) Part No. V0511-5736-2



1WAKA00050A01enUS

(1) Part No. V0511-5754-1



1BCAAAAAP070E

HOW TO USE THE EMERGENCY EXIT

If you should become trapped in the cab, you can remove the rear window to get out.

- The rear window in the machine serves as the primary alternate exit.
- You will need to remove the rear window in order to use the primary alternate exit.

1. Pull on the ring at the top of the rear window in order to remove the rear window.
The ring will remove the seal that holds the rear window in place.
2. When the seal is taken out, remove the rear window and exit the cab.

(2) Part No. RB419-5796-2 [Both sides]



Forbidden lift point

1BAABAUAP2720

(3) Part No. 6C040-5559-1

DANGER EXPLOSIVE GASES

Cigarettes, flames or sparks could cause battery to explode. Always shield eyes and face from battery. Do not charge or use booster cables or adjust post connections without proper instruction and training.

KEEP VENT CAPS TIGHT AND LEVEL

POISON CAUSES SEVERE BURNS

Contains sulfuric acid. Avoid contact with skin, eyes or clothing. In event of accident flush with water and call a physician immediately.

KEEP OUT OF REACH OF CHILDREN

1BAAGAAP0380

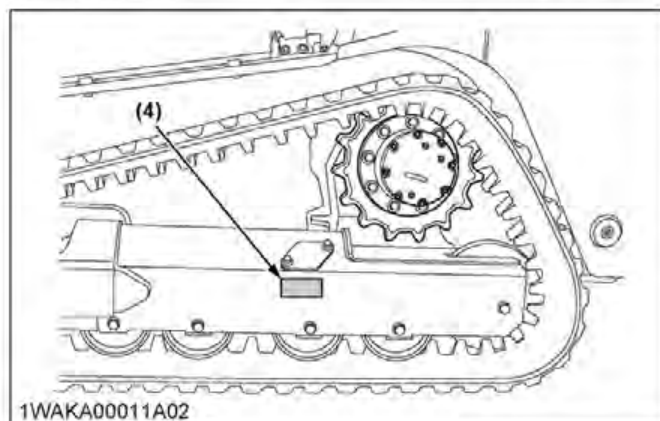
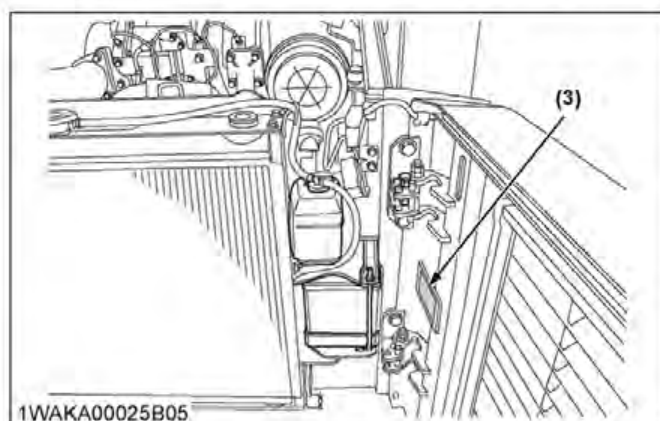
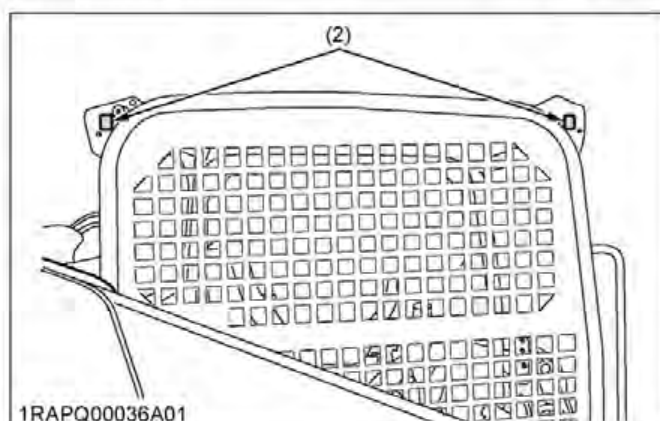
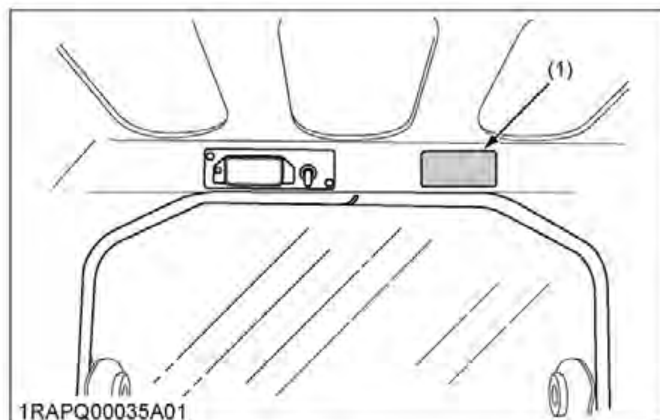
(4) Part No. V0511-5764-1 [Both sides]

Do not loosen the grease nipple completely or too quickly.



1BCAAAAAP128E

1WAKA00051A01enUS



2.2 Safety labels maintenance

- Keep safety labels clean, and free from obstructing material.
- Clean safety labels with soap, water, and soft cloth.
- Replace damaged or missing safety labels with new ones.
- If a component with safety labels affixed is replaced with new part, make sure new labels are attached in the same locations as the old components.
- Mount new safety labels on a clean dry surface and press any bubbles to the outside edge.

2. GENERAL

GENERAL WORKING INSTRUCTIONS

1. General working precautions

- When servicing, observe the safety regulations in the operator's manual and workshop manual.
- Clean the machine before maintenance.
- Before working, remove the negative (-) terminal from the battery or turn off the battery isolator switch.
- Disassemble the machine at a clean location.
- Whenever a special tool is required, use the special tool that Kubota recommends. Or, craft the special tools according to the illustrations in this manual.
- Use genuine Kubota parts to ensure safety and machine performance.

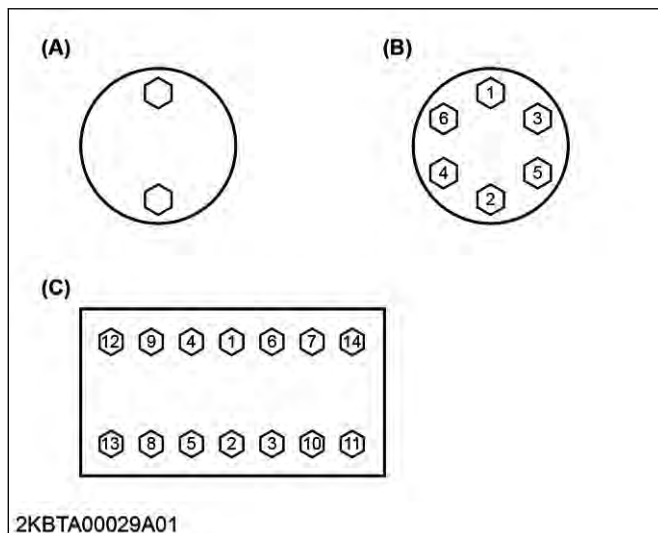


2. Tightening bolts and nuts

- Tighten the bolts and nuts with their specified torque.

NOTE

- Tighten the bolts and nuts alternately from top to bottom and left to right so the torque is distributed evenly.
- Gradually tighten the bolts and nuts two or three times.

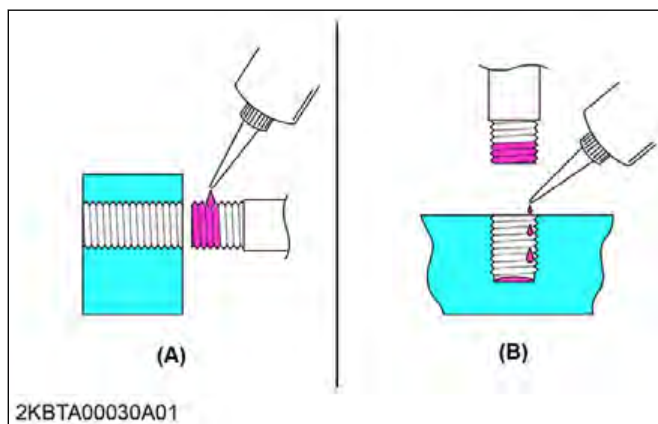


(A) Alternately
(B) Diagonally

(C) Diagonally from center to outside

3. Applying thread-locking fluid

1. Clean and dry the location where a thread-locking fluid will be applied with a solvent to remove moisture, oil, and dirt.
2. Apply the thread-locking fluid to the tip of the bolt.
3. If the threads are large, apply the thread-locking fluid all around the bolt hole.

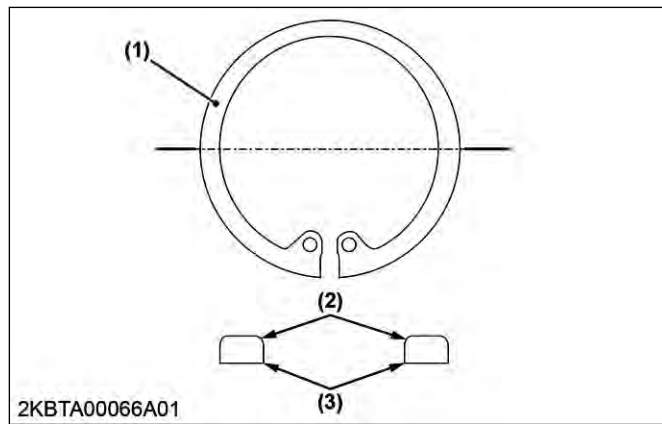


(A) Bolt hole (bolts, nuts)

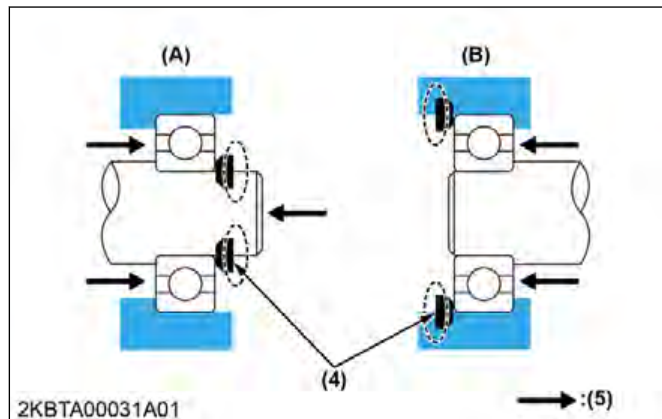
(B) Screw hole

4. Installing circlips

- When installing the circlip, assemble the circlip's angular side (3) toward the side that receives force (4) as shown in the figure.



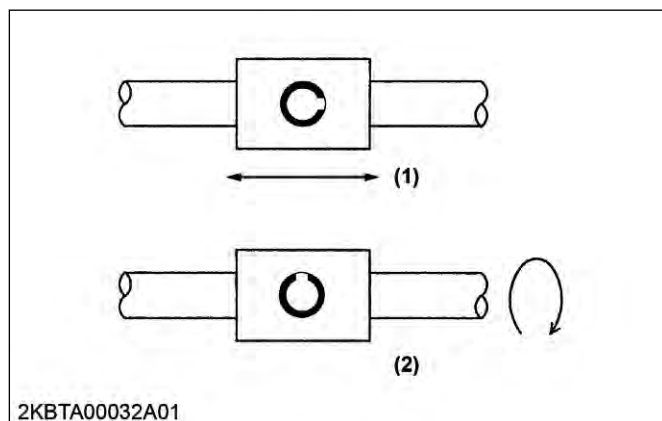
(1) Circlip
(2) Rounded side
(3) Angular side



(4) Side that receives force
(5) Force
(A) External circlip
(B) Internal circlip

5. Installing spring pins

- When installing the spring pin, assemble the slit of the spring pin in the direction that receive force as shown in the figure.

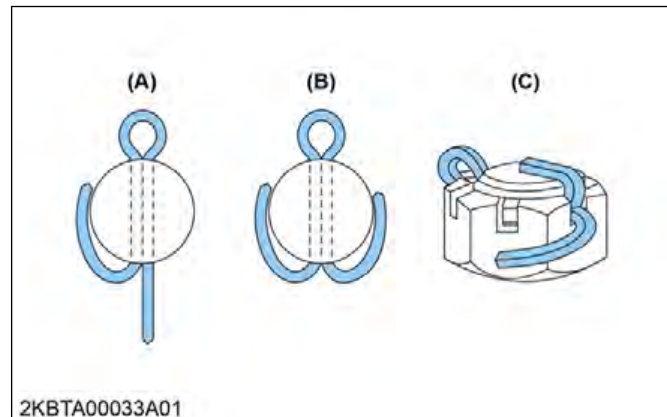


(1) Parallel movement
(2) Rotational movement

6. Handling split pin

- Replace split pins with new ones. Insert the split pins: once inserted, the two ends of the pin are bent apart to fixed it in place.

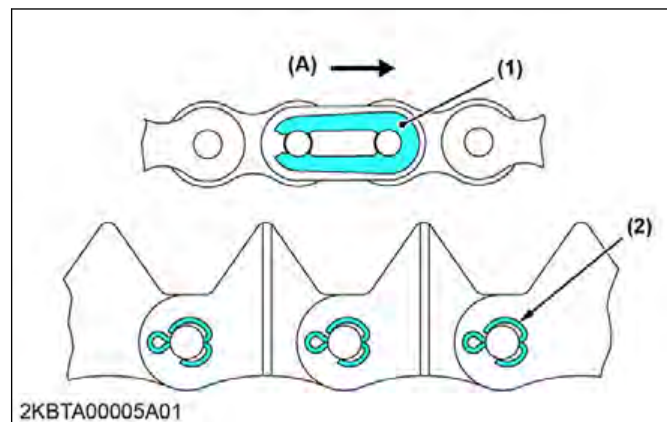
- Tighten a grooved nut to the specified torque, align the hole of the split pin to the tighten direction and use an S-shaped split.



(A) Single side split
(B) Double side split
(C) S-shaped split

7. Handling chain joint and split pin

- Assemble the chain joint with its opening facing the opposite direction of travel.
- Assemble the split pin with its opening facing the direction of travel.



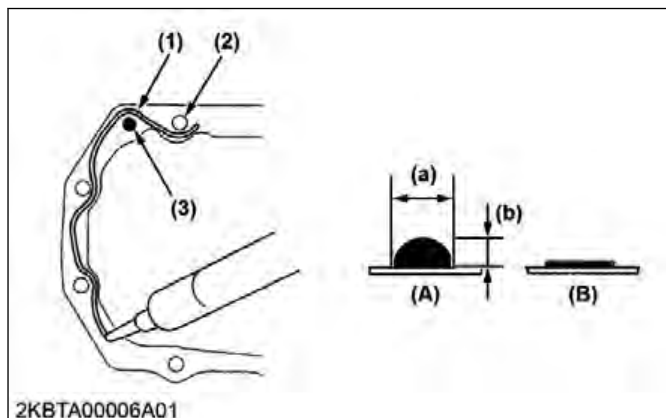
(1) Chain joint
(2) Split pin
(A) Direction of chain moving

8. Handling liquid gasket

- Use the specified liquid gasket.
- When using liquid gasket, fully remove the old gasket and grease or oil.
- When applying liquid gasket, apply it on the joint surface with a thickness of 3.0 to 5.0 mm (0.12 to 0.13 in.) without making any gaps.
- When applying liquid gasket near the bolt hole (2), apply it in the inner side.
- If there is a risk of oil leakage or if the hole goes all the way through when applying liquid gasket near the dowel pin (3) hole, apply it in the inner side.

If there is no concern of oil leakage, apply it on the outer side.

- Reassemble within 15 minutes after applying; wait for 30 minutes or more then fill with oil.



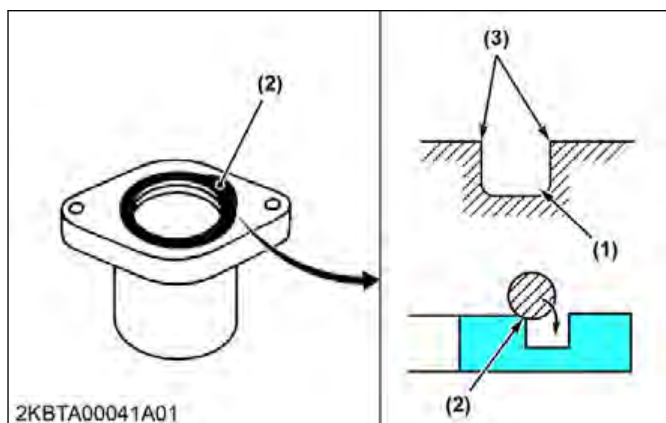
- | | |
|-----------------------|--------------------------------------|
| (1) Application route | (a) 3.0 to 3.5 mm (0.12 to 0.13 in.) |
| (2) Bolt hole | (b) 3.0 to 5.0 mm (0.12 to 0.19 in.) |
| (3) Dowel pin | |
| (A) Correct | |
| (B) Incorrect | |

9. Replacing O-rings

1. Remove the burr and clean the O-ring groove.
2. Lubricate the O-ring. Do not apply any grease to the floating seal.
3. Put the O-ring in the groove.

NOTE

- Do not twist the O-ring.
- Remove the burr to avoid damage on the O-ring caused by the burr.



- | | |
|-------------------|----------|
| (1) O-ring groove | (3) Burr |
| (2) O-ring | |

10. Replacing oil seals

1. Do not face the lip of the oil seal in the wrong direction. Face the seal lip toward the material to be sealed.
2. Use a press to install the oil seal until firmly fixed to the boss.

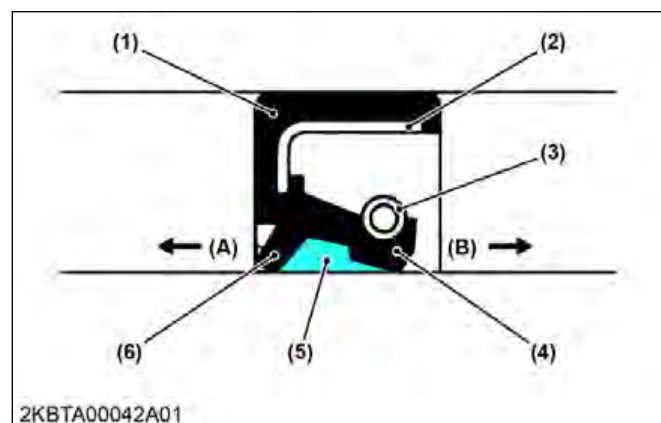
NOTE

- In cases when installing an oil seal without a press, place a wooden board on the seal and gently tap the board with a hammer; install the oil seal straightly and evenly.

3. Grease the seal lip and dust lip.

NOTE

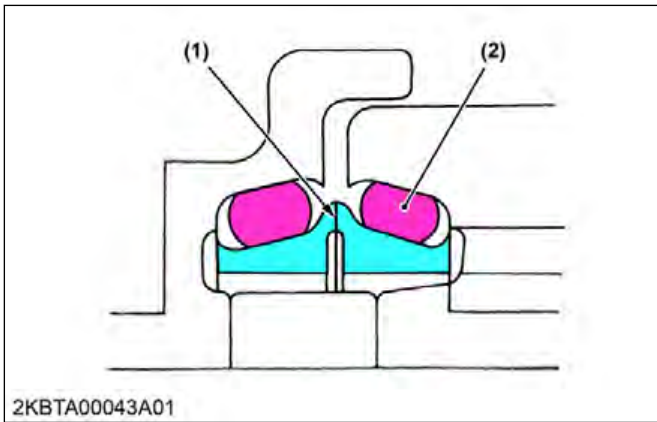
- If the seal has a dust lip, grease the gap between the lips.
- After oil seals are replaced, grease the moving parts around the lip to prevent the dry surfaces from wearing against each other during engine start up.



- | | |
|----------------|--------------|
| (1) Packing | (5) Grease |
| (2) Metal ring | (6) Dust lip |
| (3) Spring | (A) Air side |
| (4) Seal lip | (B) Oil side |

11. Replacing floating seals

1. Apply oil appropriately to both sides of the O-ring and the contact surface.
2. Do not twist the O-ring when installing the floating seal.
3. Apply oil thinly to the sliding surfaces.
4. Install the floating seal in parallel to the sliding surfaces, O-rings, and housings.
5. After installation, rotate the floating seal for 3 times to make an oil film on the sliding surface.



(1) Sliding surface (2) O-ring

12. Connecting hydraulic hoses

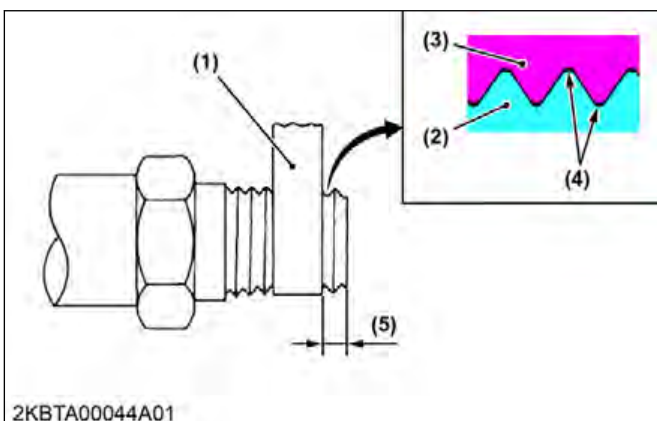
1. Clean the inside of the hose fittings.
2. Tighten with the specified torque.
3. Apply pressure on the hydraulic hose to check for oil leakage.

13. Wrapping thread seal tape

1. Wrap the thread seal tape around the taper threads two or three turns.
2. Tighten the taper thread with the specified torque.

NOTE

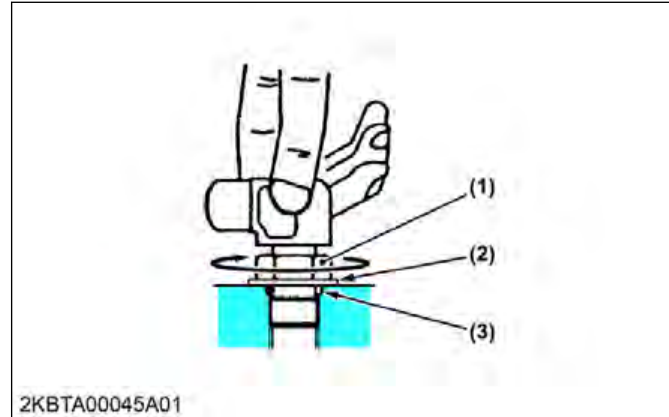
- Do not loosen the taper thread after tightening to avoid oil leakage.
- Do not wrap the thread seal tape on the first and second threads to avoid contamination in the hydraulic circuit.



(1) Thread seal tape (2) Male thread (3) Female thread (4) Clearance (5) First and second threads from the screw tip

14. Installing elbows with male seat

1. Clean the male seat surface and seal.
2. Loosen the lock-nut until the top end.
3. Install and tighten the elbow by hand until the male seat touches the material surface.

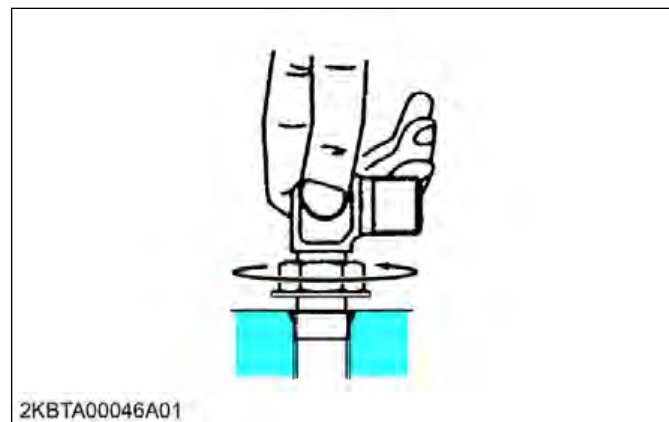


(1) Lock-nut (2) Seat (3) Seal

4. Adjust the direction of the elbow.

NOTE

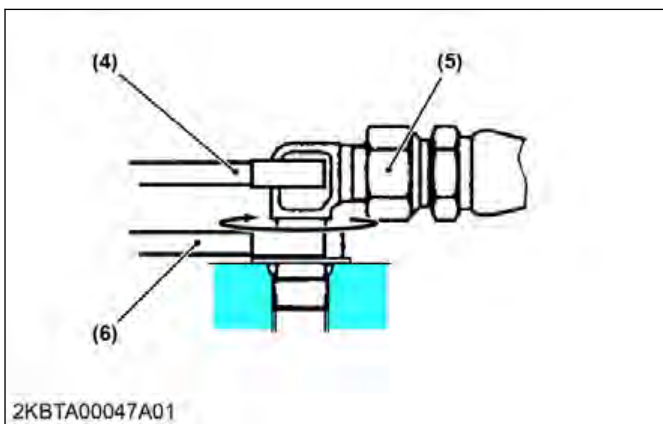
- Do not loosen to more than one turn.



5. Tighten the lock-nut with the specified torque.

NOTE

- Check for oil leakage.

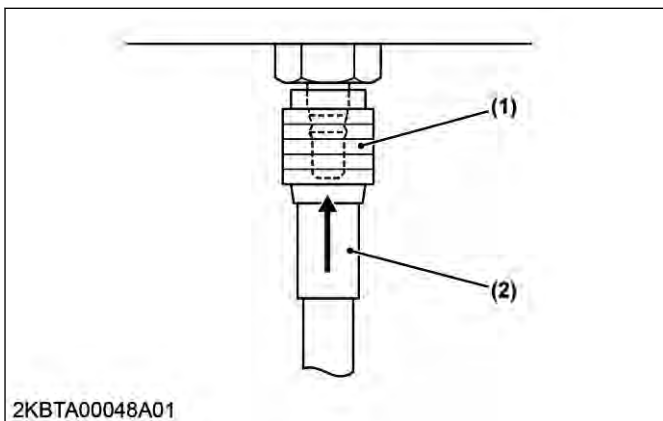


(4) Wrench
(5) Hose

(6) Torque wrench

15. Connecting and disconnecting quick hose couplings

1. Push the metal fittings in the direction of the arrow mark.



(1) Plastic part

(2) Metal fitting

2. Pull the plastic part in the opposite direction of the arrow mark.
3. Disconnect the quick hose coupling.
4. Push the quick hose coupling in the direction of the arrow mark to connect.
5. Confirm that the hose is installed correctly.

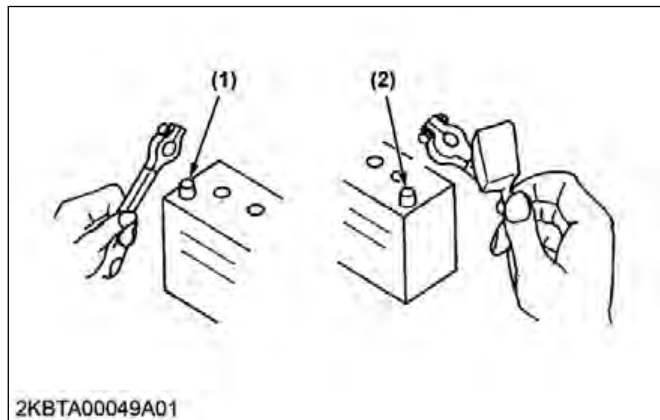
16. Handling the battery



CAUTION

- When removing battery cables, disconnect negative (-) terminal first.
- When installing battery cables, connect positive (+) terminal first.
- Do not install any battery with a capacity (Ah) other than is specified.

- Securely attach the terminal covers on the cables when connecting the cables to the battery terminal posts. There is a danger of short-circuiting if the tip of the cables attached to the battery terminal post is exposed.
- Do not allow dirt and dust to collect on the battery.
- Connect the battery terminals after removing dust, old grease, blue rust and others.
- Apply conductive grease thinly to the battery terminal posts to prevent corrosion.



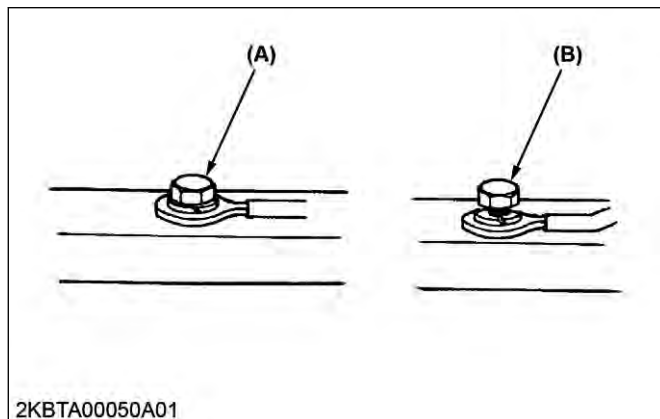
(1) Battery negative (-) terminal (2) Battery positive (+) terminal

17. Handling wire harness



CAUTION

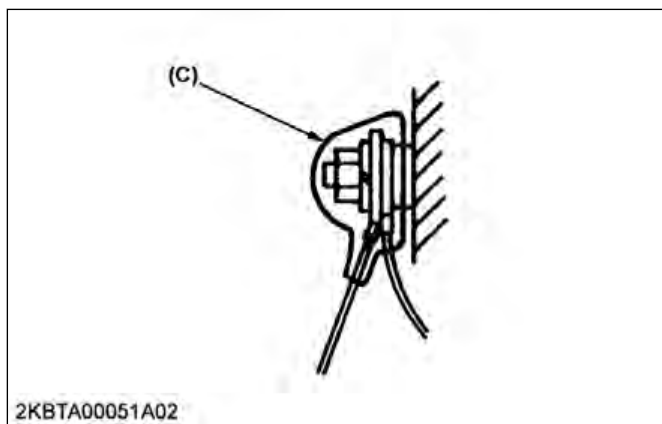
- Do not let an unprotected wire harness to come in contact with other components.
- Do not clamp the wire harness to fuel hoses.
- If the wire harness is damaged, replace it immediately with a new one.
- Do not alter the electrical device and wire harness.
- Tighten the electrical terminals securely.



(A) Good

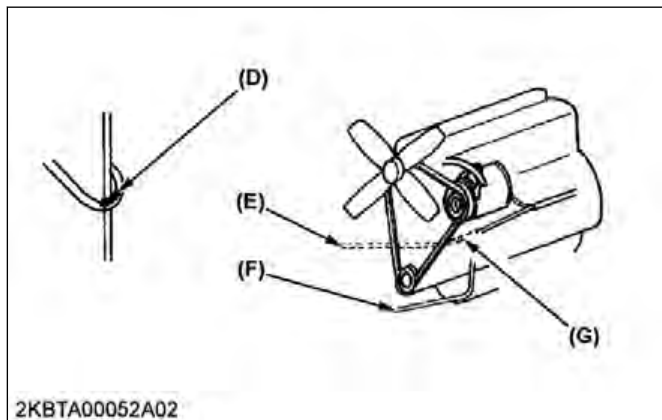
(B) Bad: Loose bolt

- Check the electrical terminal protection and clamping conditions before connecting the battery cable.



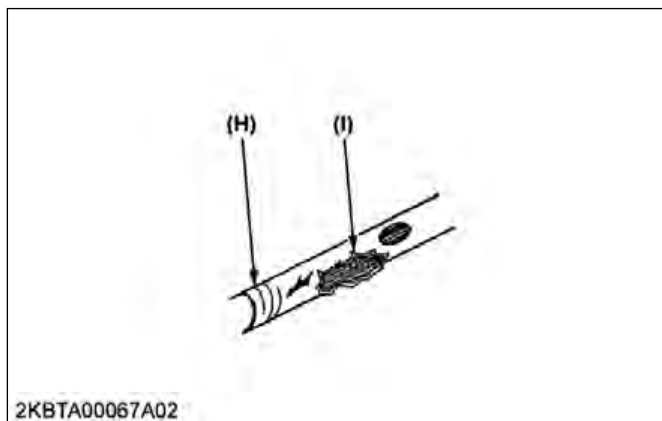
(C) Covered completely with a protection cover

- Keep the wire harness away from hazardous positions such as rotating parts or high-temperature sections.



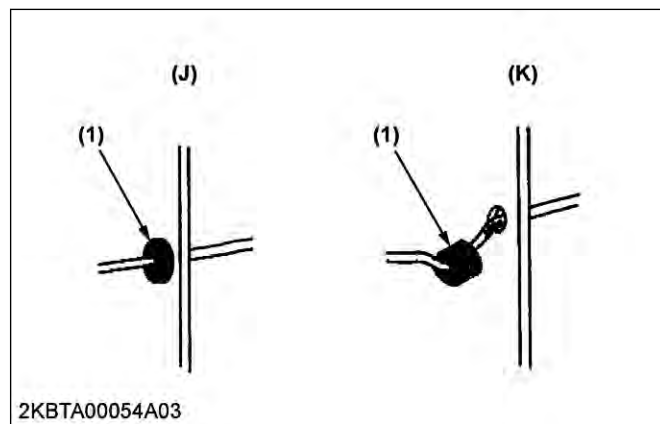
(D) Hazardous position (G) Hazardous position
(E) Wiring position: bad
(F) Wiring position: good

- If wire harness is damaged or degraded, replace immediately.



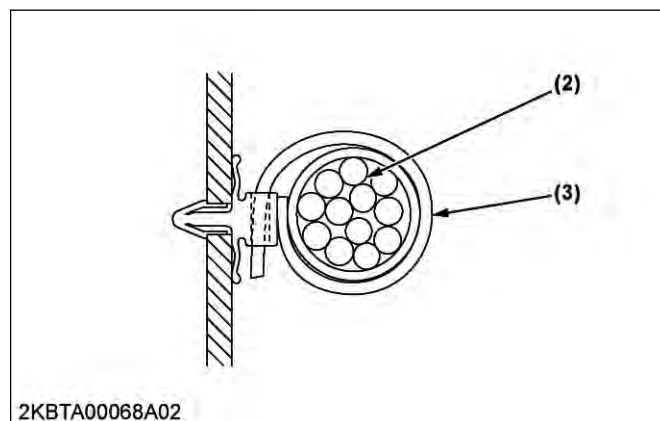
(H) Damaged (I) Torn

- Install the grommet securely.



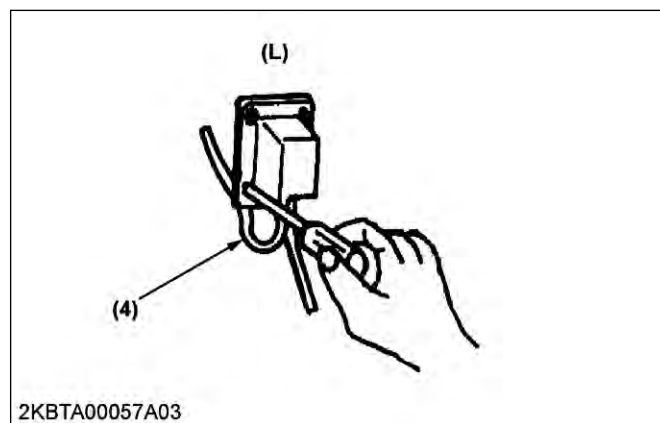
(1) Grommet (K) Bad: poor installation
(J) Good

- Clamp the wire harness securely. Do not damage the wire harness by the clamp.
- Clamp the wire harness correctly. Do not slack, twist, and pull.



(2) Wire harness (3) Clamp

- Do not pinch the wire harness when installing parts.

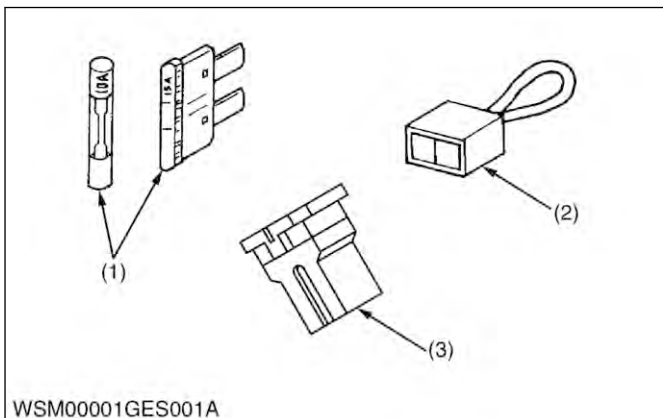


(4) Wire harness (L) Bad

18. Handling fuses

- Always use fuses of the specified capacity.
- Do not use steel or copper wiring instead of fuse.
- Do not install work light or radio without auxiliary power line.

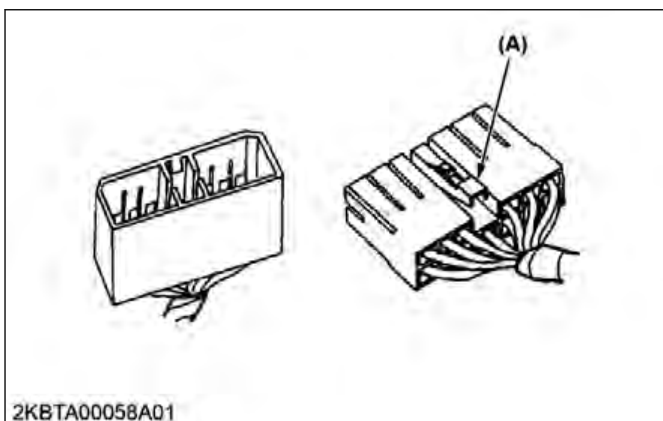
- Do not install auxiliaries to the fuses. The fuses may blow.



- (1) Fuse (2) Fusible link (3) Slow blow fuse

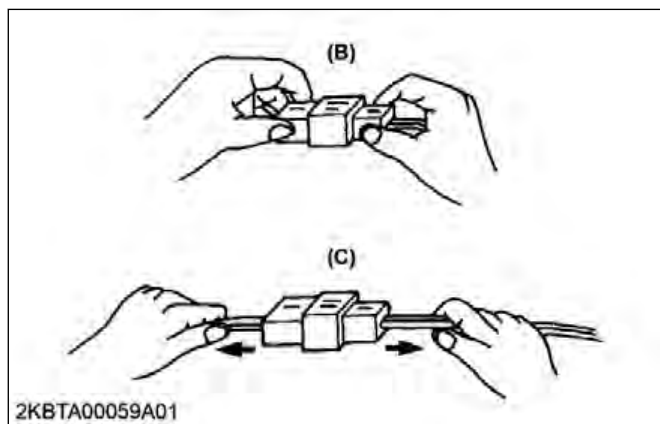
19. Handling connectors

- When disconnecting the locking connectors, be sure to disengage the lock before disconnecting. There are two kinds of locks: one requires pressing and the other requires pulling.



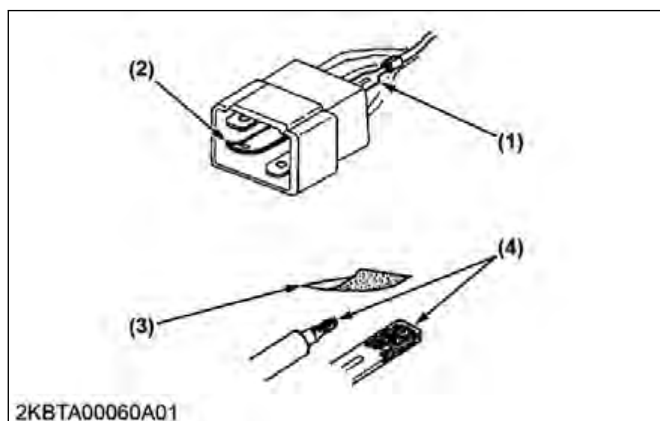
(A) Press

- Hold on tightly to the connectors when disconnecting them.
- Do not pull wire harness itself.



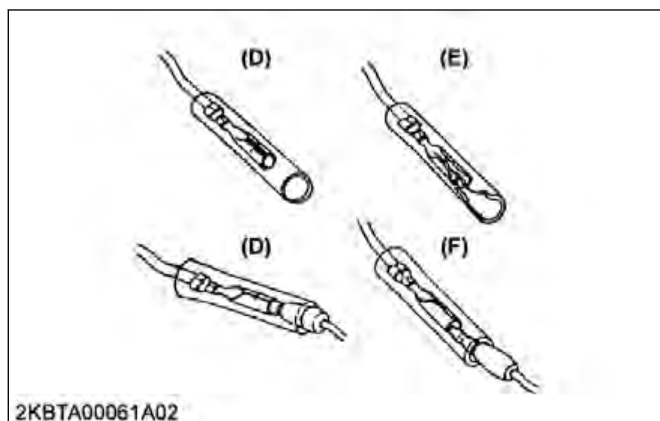
(B) Good (C) Bad

- Make sure the terminal condition of the connectors is not bent, rusty, and so on.
- If the terminal is rusted, remove rust with sandpaper. However, do not polish the terminal of the waterproof connector or the plated terminal.



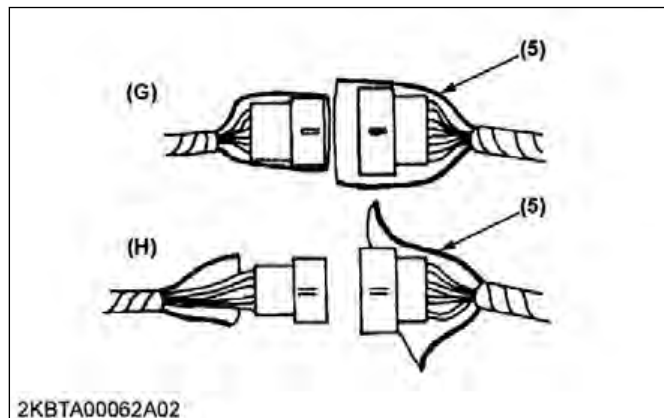
(1) Missing terminal (2) Bent terminal (3) Sandpaper (4) Rust

- Cover the female bullet terminals and male bullet terminals securely with the plastic covers.
- Make sure that the bullet terminals are secure and connected securely to the tip.



(D) Good (E) Bad: damaged cover (F) Bad: poor connection

- Cover the female connectors and male connectors securely with the plastic covers.

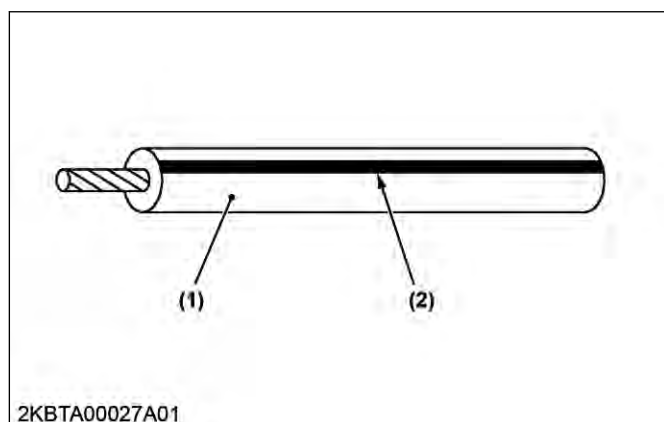


(5) Cover
(G) Good

(H) Bad: damaged cover

20. Wiring color

- Wire colors are specified in the color codes.



(1) Wire color

(2) Stripe

Wiring Colors	Color code
Black	B
Brown	BR, Br
Green	G
Gray	GY, GR
Blue	L
Light green	LG, Lg
Orange	OR, O
Pink	P
Purple	PU, V, Pu
Red	R
Sky blue	SB, Sb
White	W
Yellow	Y

- This symbol of "/" shows color with stripe(s).
(An example)

W/R:

White with red stripe

21. Washing the machine with a high pressure washer

Use a high pressure washer properly to avoid personal injuries and damages to the machine.

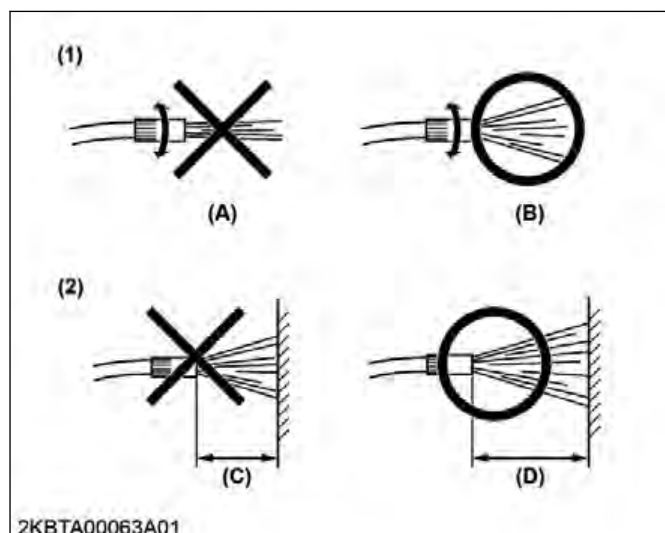


CAUTION

- Damaged or cut the wire harness may cause fire.
- Damaged hydraulic hoses or oil seals may cause injury due to hydraulic oil gushing out.

IMPORTANT

- Water infiltration may cause machine problems.
- Adjust the high pressure washer nozzle for a wide spray. Do not adjust to pencil point spray.
- Spray the water at least 2 m away from the machine.



- (1) Adjusting the washer power (C) Less than 2 m (80 in.)
(2) Washing distance (D) Over 2 m (80 in.)
(A) Pencil point spray
(B) Wide spray

22. Dispose fluids correctly

- Do not dispose fluids on the ground, down the drain, into a stream, pond, or lake. Obey related environmental protection regulations when you dispose of oil, fuel, coolant, electrolyte, and other dangerous materials.



2. GENERAL

PRELIMINARY WORKING INSTRUCTIONS

1. Removing the battery

⚠ CAUTION

- Keep a fire (welding sparks, grinding sparks, cigarettes) away from the battery. The battery produces oxygen and hydrogen gas which are flammable.
- Disconnect negative (-) terminal first when removing the battery.
- Connect positive (+) terminal first when connecting the battery cable.

Removing

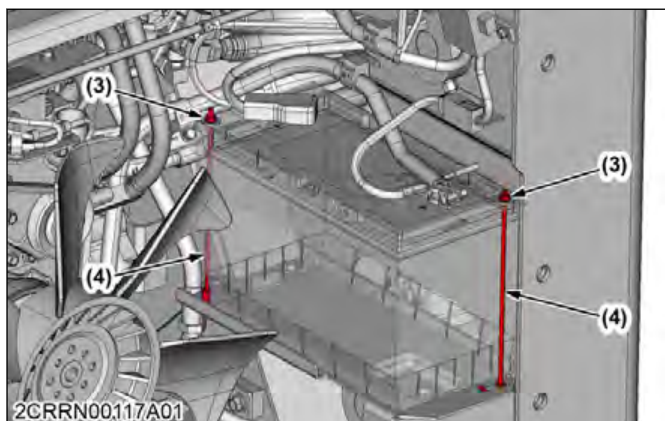
1. Disconnect the battery cables from the battery.



(1) Negative (-) terminal (2) Positive (+) terminal

■ NOTE

- Wrap the terminals with insulating tape after disconnecting.
2. Remove the 2 nuts to remove the 2 battery-fixing bolts.



(3) Nut ×2 (4) Battery fixing bolt ×2

3. Remove the battery.

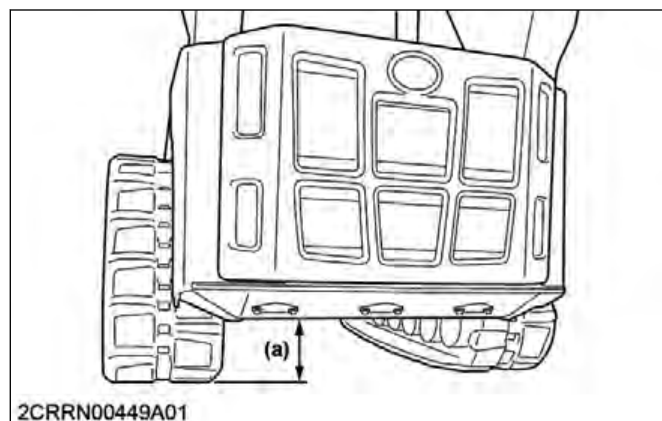
2. Jacking up the machine

⚠ CAUTION

- Do not work underneath when the machine is jacked up.
- Place the machine on the jack stands securely when lifting the machine.

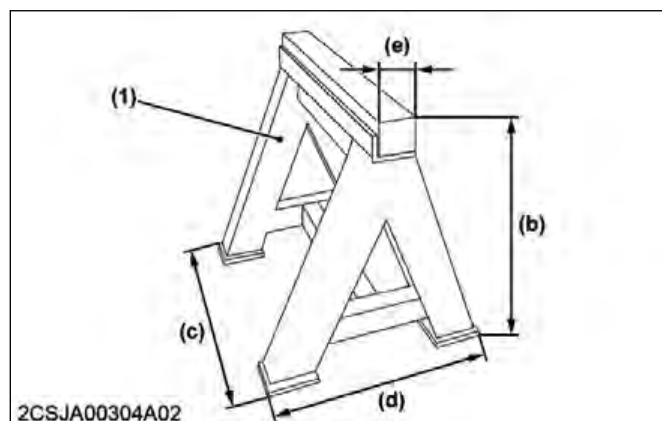
Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Prepare proper jack stands based on the dimension (a).



(a) 233 mm (9.17 in.)

Recommended jack stand



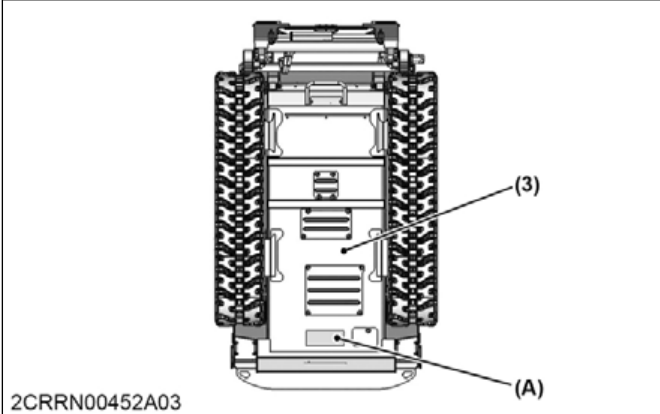
(1) Jack stand

2. GENERAL

	Dimensions
(b)	320 mm 12.6 in.
(c)	400 mm 15.7 in.
(d)	290 mm 11.5 in.
(e)	75 mm 3.0 in.

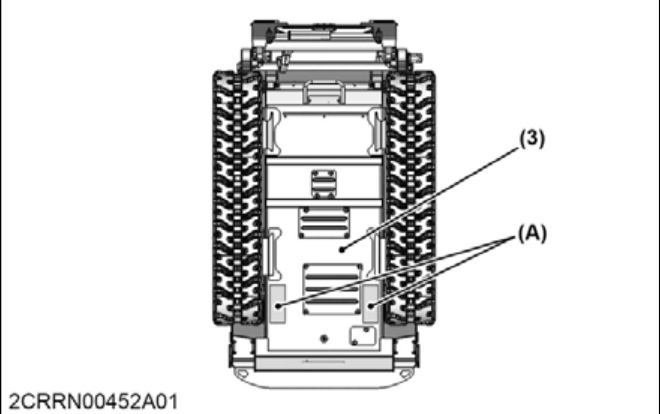
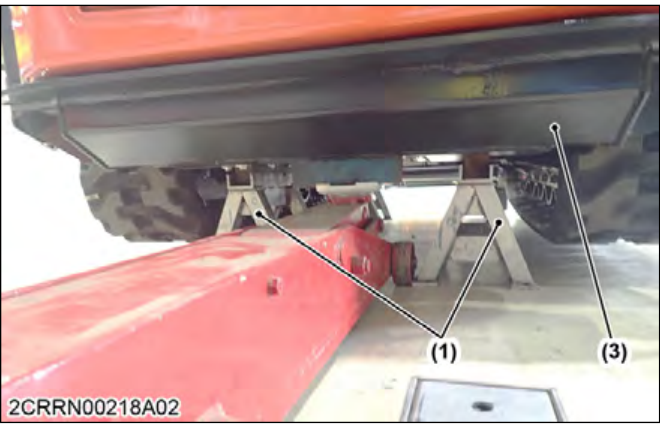
Jacking up the machine

1. Jack up the rear side of the machine with a hydraulic jack.



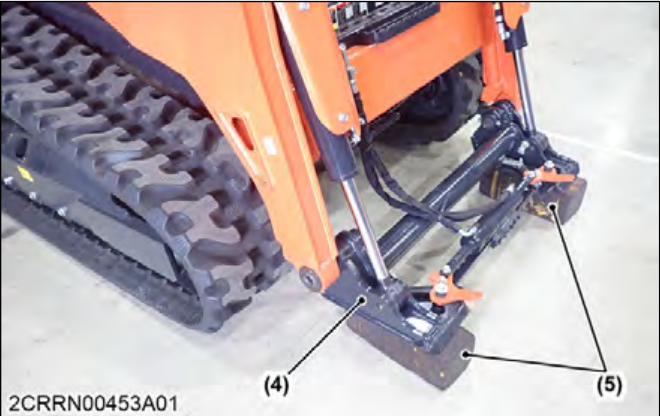
- (2) Hydraulic jack
(3) Main frame
(A) Contact surface

2. Put the 2 jack stands under the main frame.



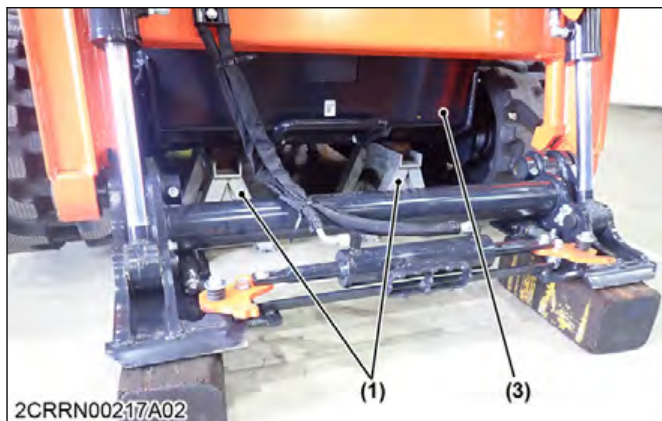
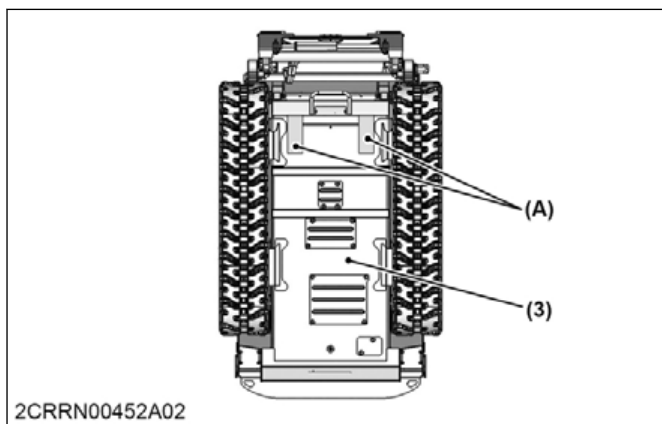
- (1) Jack stand
(3) Main frame
(A) Contact surface

3. Operate the bucket to jack up the front of the machine.

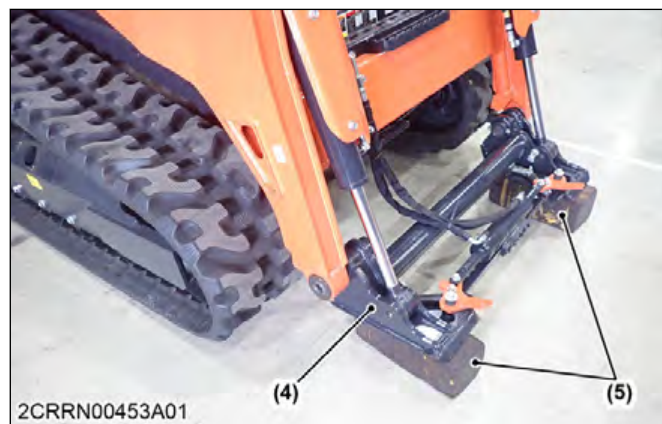
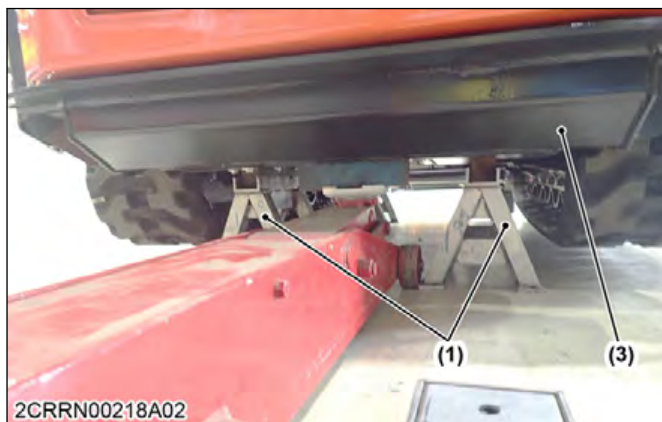


- (4) Quick hitch
(5) Cushion

4. Put the 2 jack stands under the main frame.



- (1) Jack stand
- (A) Contact surface
- (3) Main frame
5. Lower the machine and place the machine on the jack stands.
6. Place the quick hitch on the cushions.

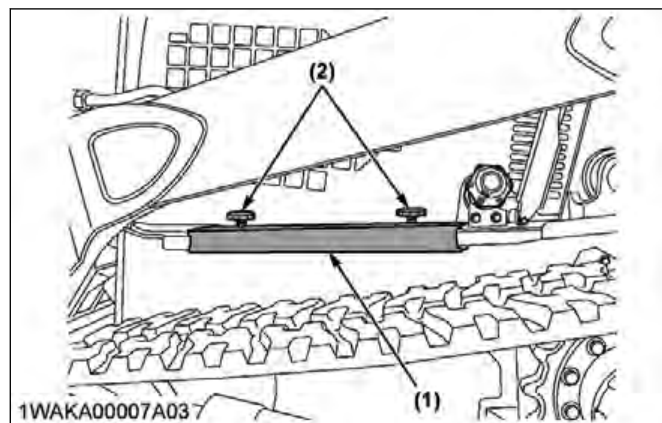


3. Locking the lift arm

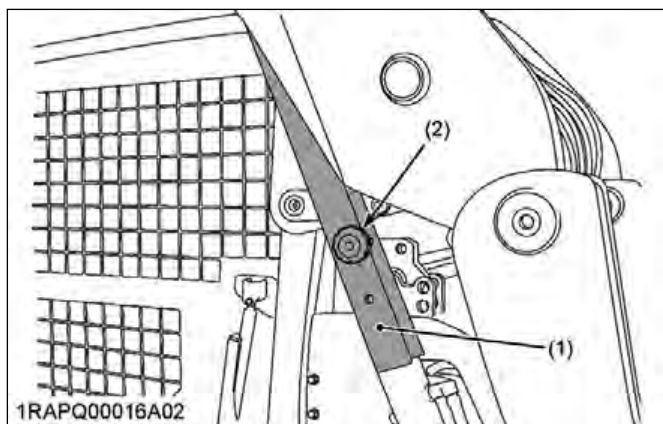
⚠ WARNING

- Do not work on the machine with the lift arm up unless the lift arm is locked by the lift arm stopper.

1. Park the machine on the level and firm ground, and lower the lift arm to the ground.
2. Remove the attachment if installed.
3. Remove the lift arm stopper.



- (1) Lift arm stopper
- (2) Bolt ×2
4. Engage the parking brake and slowly raise the lift arm to the maximum height.
5. Activate the hydraulic lock by raising the armrests.
6. Install the lift arm stopper from the front side and fix with the 2 bolts.



(1) Lift arm stopper

(2) Bolt

**WARNING**

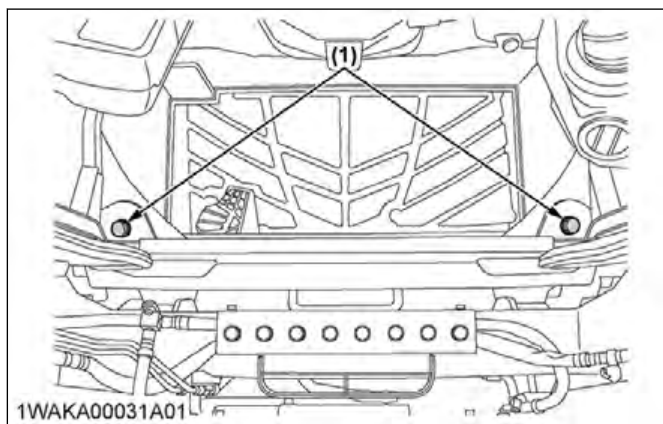
- Fit the dented side of the lift arm stopper with the rod of the lift arm cylinder.
- Fit the flat side of the lift arm stopper with the lift arm cylinder.

- Lower the armrests and press the hydraulic unlock switch.
- Slowly lower the lift arm to place it on the lift arm stopper.

4. Tilting up the cab**WARNING**

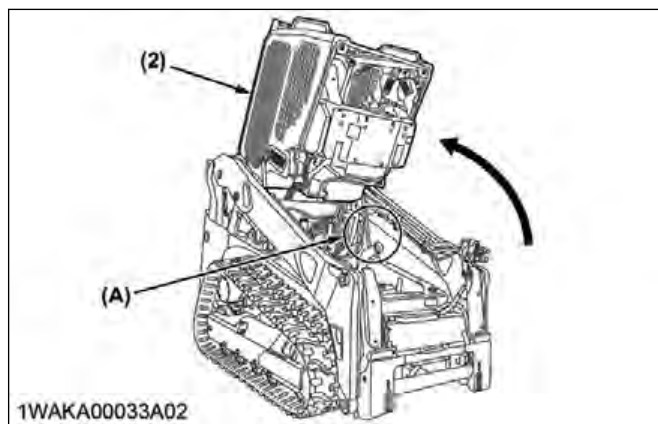
- Do not tilt up the cab while the engine is running.

- Park the machine on the firm and level ground.
- Lower the front attachment to the ground.
- Stop the engine.
- Remove the 2 bolts from the cab.

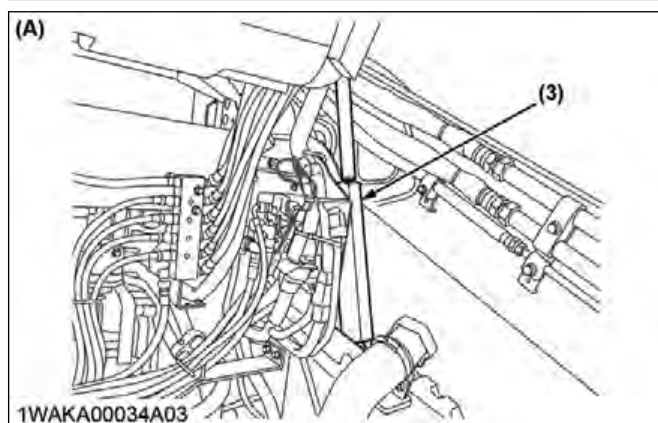


(1) Bolt (M16 × 80) ×2

- Tilt up the cab until the latch engages.



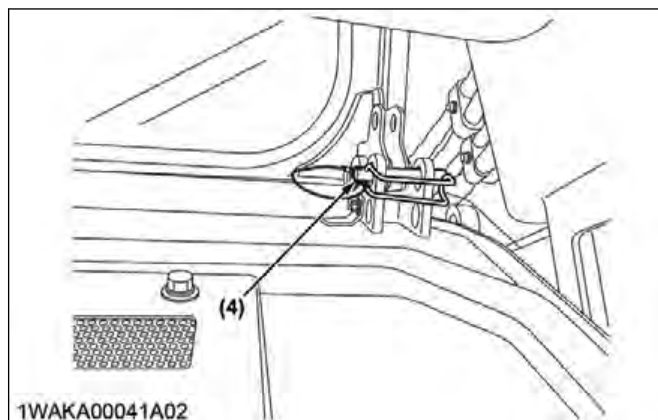
(A)



(2) Cab

(3) Latch

- Install the lock pin.

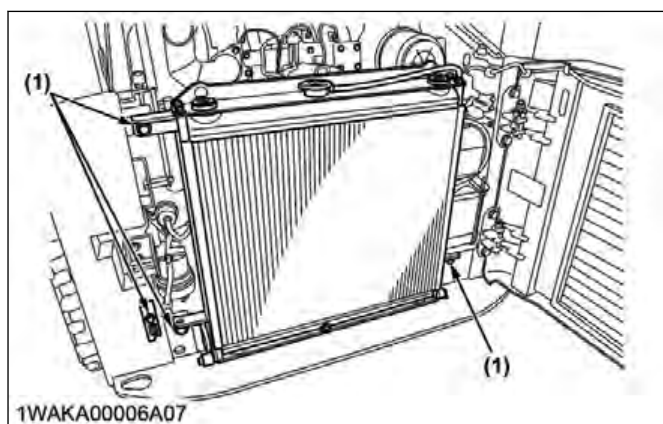


(4) Lock pin

5. Tilting the radiator**CAUTION**

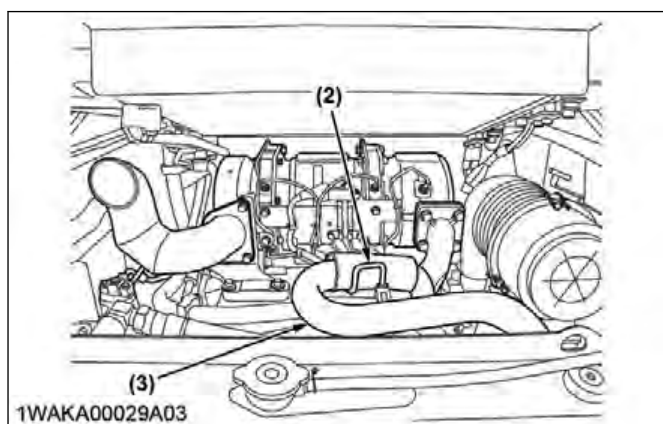
- Stop the engine before tilting the radiator.
- Do not work soon after stopped the engine.

- Open the rear bonnet.
- Remove 4 bolts.



(1) Bolt (M14 × 40) ×4

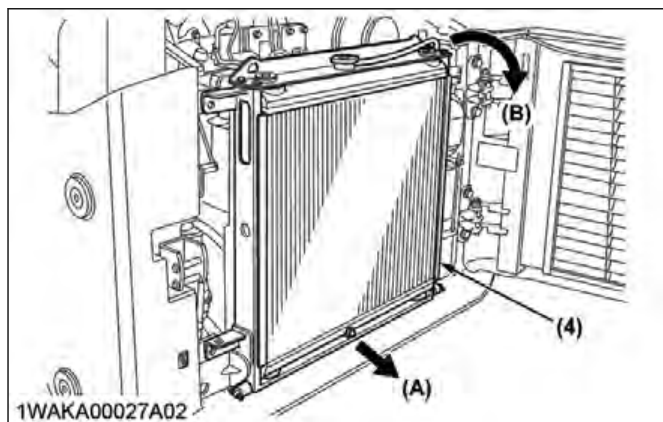
3. Remove the radiator hose from the stay.



(2) Stay

(3) Radiator hose

4. Pull and tilt the radiator.

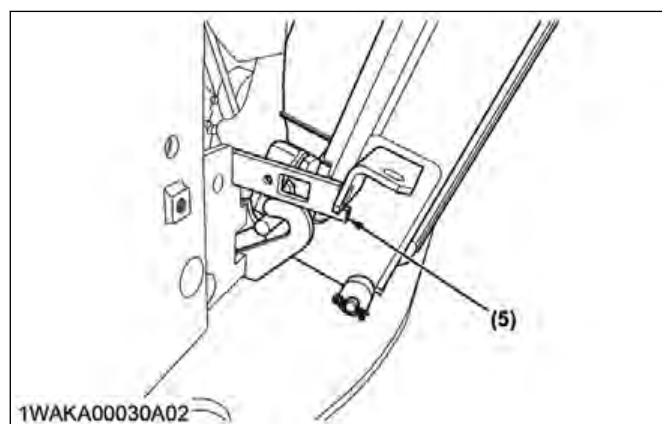


(4) Radiator

(B) Tilt

(A) Pull

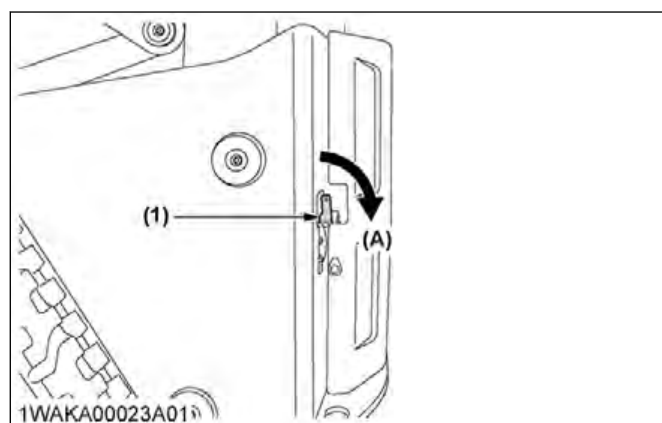
5. Place the radiator on the stopper to prevent the radiator from falling down.



(5) Stopper

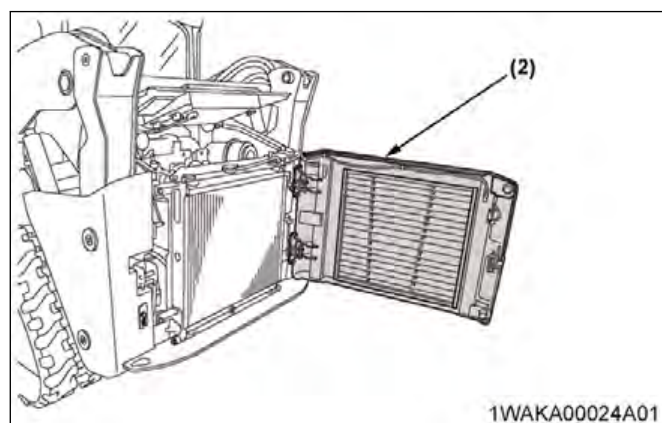
6. Opening the rear bonnet

1. Pull the lever and open the rear bonnet.



(1) Lever

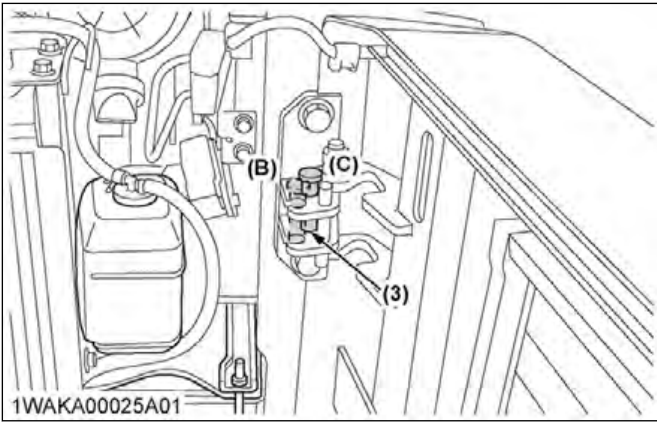
(A) Pull



(2) Rear bonnet

2. Insert the pin into the lock position to fix the rear bonnet.

2. GENERAL



- (3) Pin
(B) Original position
(C) Lock position



CAUTION

- Check that the rear bonnet is securely locked.

7. Removing and installing the upper bonnet

CAUTION

- Wear gloves, work clothing and eye protector to protect your skin and eyes. The liquid refrigerant may cause the frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

IMPORTANT

- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using parts which is not specified by R134a may cause leakage, performance decrement, and so on.
- Apply compressor oil to every O-ring to avoid damage when installing.

Preparing

1. Vacuum the refrigerant from the cooling circuit.

Removing

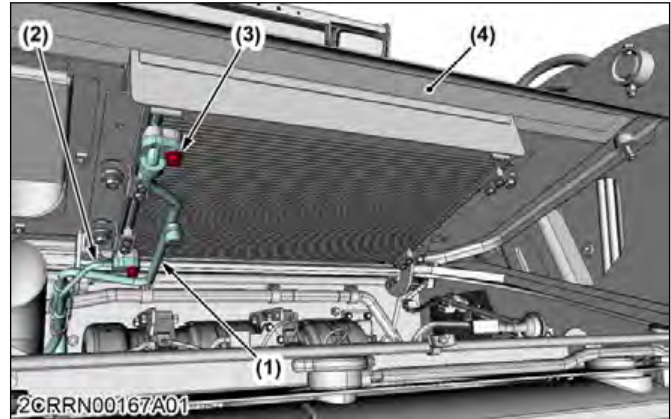
1. Open the rear bonnet and insert the pin into the lock position.



CAUTION

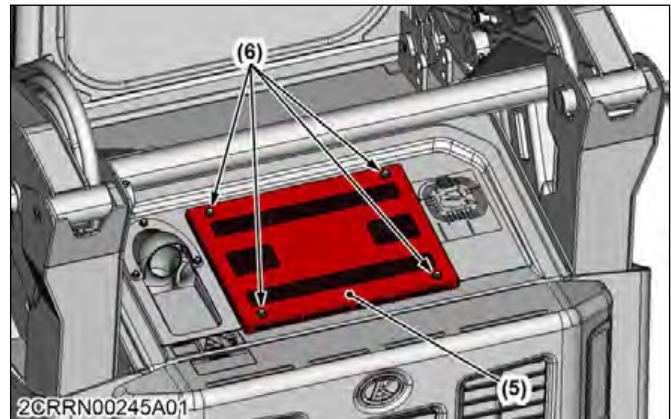
- Check that the rear bonnet is securely locked.

2. Open the upper bonnet.
3. Remove the 2 bolts and disconnect the discharge hose and liquid hose from the condenser.



- (1) Discharge hose
(2) Liquid hose
(3) Bolt (M6 × 25) ×2
(4) Upper bonnet

4. Remove the 4 bolts to remove the fan cover.



- (5) Fan cover
(6) Bolt (M10 × 20) ×4

Mass

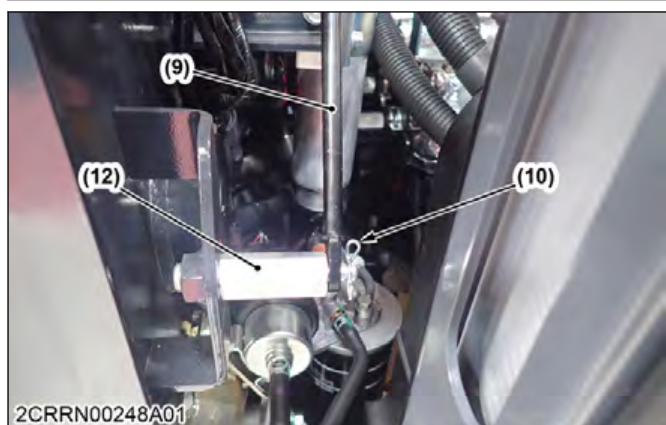
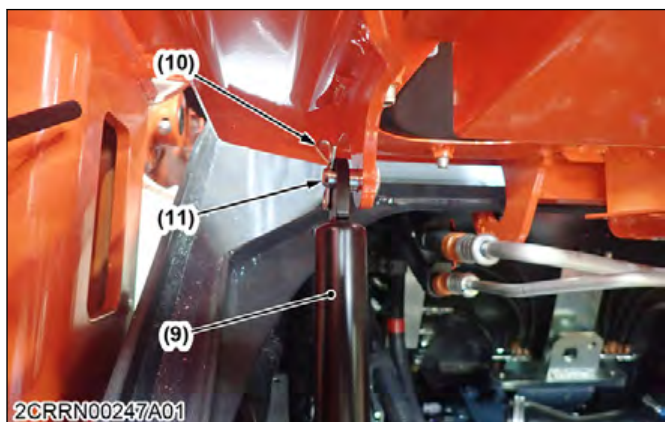
Fan cover	Approximately 4.0 kg Approximately 8.8 lbs
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5. Remove the connector of the fan and the grommet from the upper bonnet.



(7) Connector (8) Grommet

6. Remove the 2 snap pins and the 2 pins to remove the damper.



(9) Damper (12) Pin
(10) Snap pin x2
(11) Pin

7. Remove the snap pin to remove the upper bonnet.



(4) Upper bonnet (13) Snap pin

Mass

Upper bonnet	Approximately 12 kg Approximately 26 lbs
--------------	---

Installing

■ IMPORTANT

- Charge the refrigerant after installing.

Tightening torque

(6) Bolt	48.1 to 55.9 N · m 4.9 to 5.7 kgf · m 35.5 to 41.2 lbf · ft	—
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8. Vacuuming the hydraulic tank

When removing the hydraulic devices and hydraulic hoses, vacuum the hydraulic tank to reduce the hydraulic oil leakage.

- Replace the oil tank cap with a vacuum plug.
- Plug the air breather hose on the hydraulic tank.
- Connect the vacuum pump and vacuum plug with a hose.
- Connect an air hose to the vacuum pump and vacuum the hydraulic tank.



9. Vacuuming the refrigerant

CAUTION

- Wear gloves, work clothing and eye protector to protect your skin and eyes. The liquid refrigerant may cause the frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

IMPORTANT

- The R134a refrigerant must be handled by trained personnel when measuring, vacuuming, or charging.
- Work at the clean and dry work space with clean and dry tools.
- Follow the manifold gauge manufacturer's manual for details when handling the manifold gauge.
- Follow the refrigerant vacuum machine manufacturer's manual for details when handling the refrigerant vacuum machine.

1. Close the high and low pressure valves of the manifold gauge.



- (1) Manifold gauge
- (2) High pressure valve
- (3) Low pressure valve
- (4) Red charging hose
- (5) Blue charging hose
- (6) Yellow charging hose

2. Connect the yellow charging hose to the refrigerant vacuum machine.
3. Connect the red charging hose to the high pressure charging port and the blue charging hose to the low pressure charging port.



- (4) Red charging hose
- (5) Blue charging hose
- (7) High pressure charging port
- (8) Low pressure charging port

4. Turn on the refrigerant vacuum machine.
5. Open the high and low pressure valves of the manifold gauge to vacuum the refrigerant.

NOTE

- Vacuum the refrigerant until the cooling circuit pressure decreases below -0.1 MPa.
6. Stop vacuuming, wait for 5 minutes, and make sure that the cooling circuit pressure has not increased.

NOTE

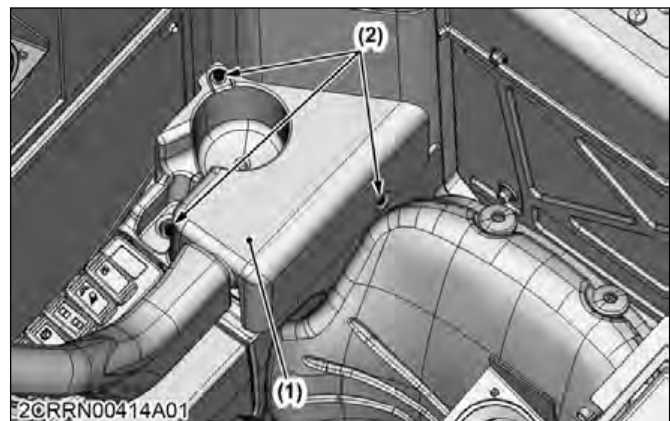
- Vacuum the residual refrigerant in the cooling circuit in the case that the cooling circuit pressure has increased.
7. Close the high and low pressure valves of the manifold gauge and disconnect the 3 charging hoses.

NOTE

- Disconnect the charging hoses from the charging ports quickly to prevent the refrigerant from leaking to the atmosphere.

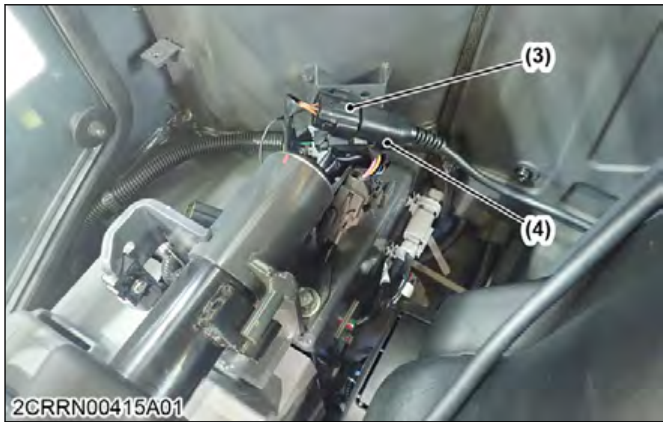
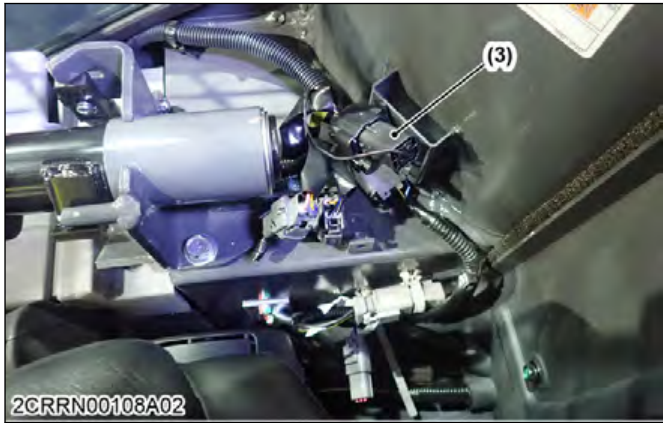
10. Connecting the Diagmaster

1. Remove the 3 bolts to remove the cover.



- (1) Cover
- (2) Bolt (M6 × 16) × 3

2. Remove the service tool connector to connect the Diagmaster.



- (3) Service tool connector (4) Diagmaster connector

2. GENERAL

CONCLUDING WORKING INSTRUCTIONS

1. Bleeding the air from the hydraulic cylinder

To prevent cavitation and seizure of the internal parts, bleed air from the hydraulic cylinder after removing and disassembling the hydraulic cylinder.

1. Set the engine speed to less than 1500 rpm.

■ IMPORTANT

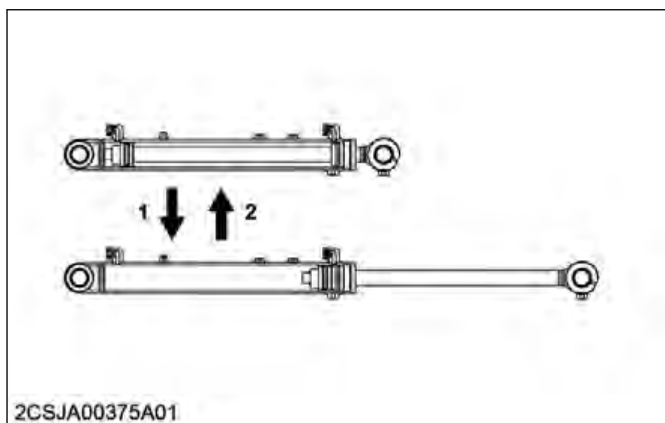
- If the engine speed is higher than 1500 rpm, the seals and bushings may be damaged.

2. Compress and extend the hydraulic cylinder slowly to bleed air.

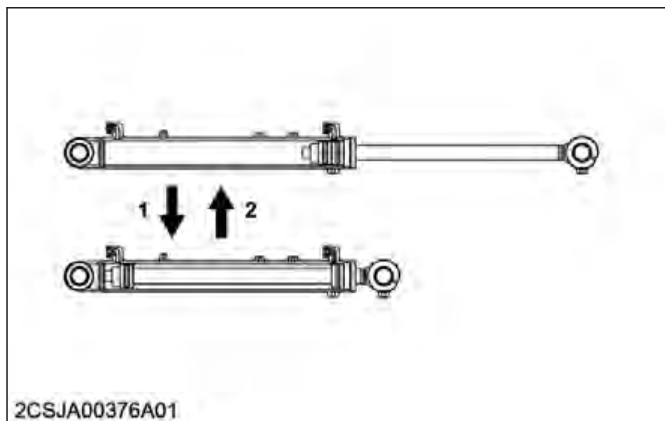
■ IMPORTANT

- Do not relieve the main relief valve at the end of the stroke.

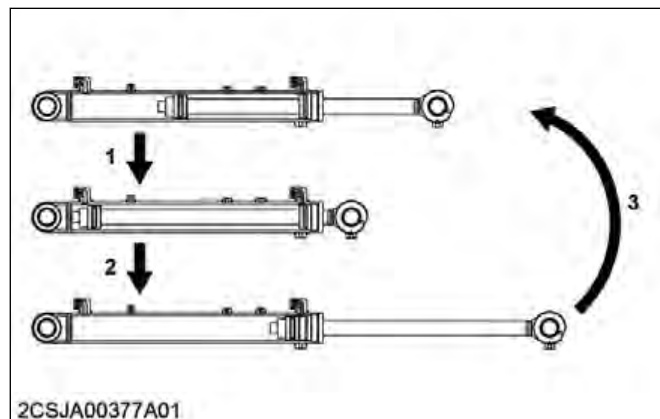
When the cylinder is fully retracted



When the cylinder is fully extended



When the cylinder is in mid-stroke



2. Charging the refrigerant



CAUTION

- Wear gloves, work clothing and eye protector to protect your skin and eyes. The liquid refrigerant may cause frostbite due to evaporation.
- Keep fire and flammable items away from the working area.
- Release the residual pressure in the manifold gauge before connecting the refrigerant canister to the manifold gauge. High residual pressure may cause explosion of the refrigerant canister.
- Do not wash the cooling circuit with water. Residual water in the cooling circuit may cause corrosion.

■ IMPORTANT

- The R134a refrigerant must be handled by trained personnel when measuring, vacuuming, or charging.
- Work at clean and dry work space with clean and dry tools.
- Use the R134a refrigerant and parts specified by R134a. Mixing with other refrigerants or using parts specified by other refrigerants may cause the trouble such as leakage or performance decrement.
- Keep the refrigerant canister upright while charging the refrigerant.
- Follow the refrigerant canister manufacturer's manual when charging and storing.

2. GENERAL

- Follow the manifold gauge manufacturer's manual when handling the manifold gauge.

Preparing

- Vacuum the refrigerant from the cooling circuit.

■ IMPORTANT

- Keep the high and low pressure valves of the manifold gauge closed to prevent air infiltration into the cooling circuit.

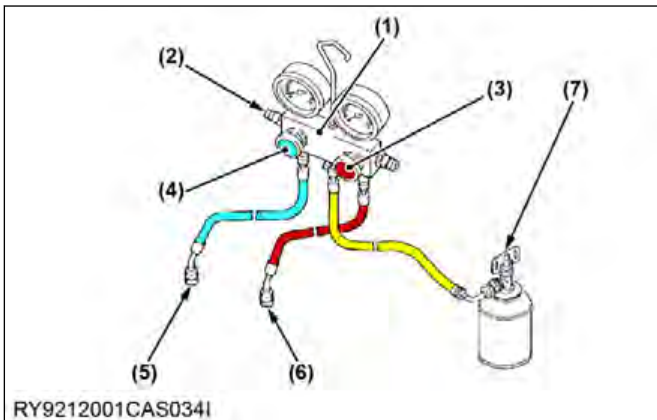
■ NOTE

- Vacuum the cooling circuit until the pressure decreases below -0.1 MPa.
- Vacuum the cooling circuit for 25 minutes to dry inside of the circuit.

- Disconnect the yellow charging hose from the vacuum machine.

Charging the refrigerant from the high pressure charging port

- Connect the yellow hose to the refrigerant canister.



- RY9212001CAS0341
- | | |
|---|--|
| (1) Manifold gauge | (6) High pressure charging port ([H] mark) |
| (2) Air bleeding valve | (7) Refrigerant canister |
| (3) High pressure valve | |
| (4) Low pressure valve | |
| (5) Low pressure charging port ([L] mark) | |

- Open the refrigerant canister valve and press the air bleeding valve to release the air in the yellow charging hose and manifold gauge.
- Open the high pressure valve of the manifold gauge to charge the refrigerant.

■ NOTE

- Soak the refrigerant canister in 40 °C (104 °F) water in the case that the refrigerant canister frosts.
- Check for the refrigerant leakage with a gas leak tester.
- Vacuum the refrigerant and repair or replace the damaged parts in case of leakage.
- Release the air in the yellow charging hose and manifold gauge after exchanging the refrigerant canister.

- Charge the remaining refrigerant from the low pressure charging port in the case that the specified volume of the refrigerant could not be charged.

Service specification

Refrigerant volume	650 g 1.4 lbs
--------------------	------------------

- Close the high pressure valve and refrigerant canister valve to stop charging, and disconnect the charging hoses.

■ NOTE

- Disconnect the charging hoses from the charging ports quickly to prevent refrigerant from leaking to the atmosphere.

Charging the remaining refrigerant from the low pressure charging port

- Close the high pressure valve of the manifold gauge.
- Open the cab door and windows.
- Start the engine and accelerate the engine speed to 1500 rpm.
- Turn on the air conditioning switch and adjust the temperature switch to the coolest level.
- Turn the fan switch to the maximum air flow (level [3]).
- Open the low pressure valve of the manifold gauge to charge the remaining refrigerant into the refrigerant circuit.
- Close the low pressure valve and refrigerant canister valve to stop charging. Stop the engine, and disconnect the charging hoses.

■ NOTE

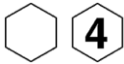
- Disconnect the charging hoses from the charging ports quickly to prevent refrigerant from leaking to the atmosphere.

TIGHTENING TORQUES

1. Bolts and nuts tightening torque

NOTE

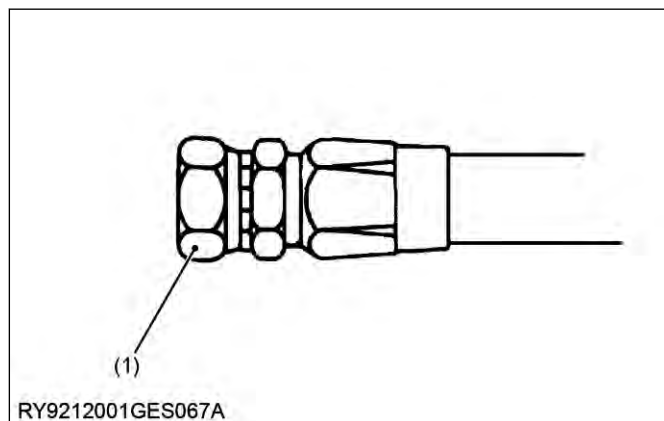
- Screws, bolts and nuts which tightening torques are not specified in this workshop manual should be tightened according to the table below.

Mark on top of bolt	 No grade or 4T						 7T						 9T		
Mark on top of nut	 No grade or 4T												 6T		
Material	Steel			Aluminum			Steel			Aluminum			Steel		
Units	N · m	kgf · m	lbf · ft	N · m	kgf · m	lbf · ft	N · m	kgf · m	lbf · ft	N · m	kgf · m	lbf · ft	N · m	kgf · m	lbf · ft
M6	7.9 to 9.3	0.80 to 0.95	5.8 to 6.8	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	9.81 to 11.2	1.00 to 1.15	7.24 to 8.31	7.9 to 8.8	0.80 to 0.90	5.8 to 6.5	12.3 to 14.2	1.25 to 1.45	9.05 to 10.4
M8	18 to 20	1.8 to 2.1	13 to 15	17 to 19	1.7 to 2.0	13 to 14	24 to 27	2.4 to 2.8	18 to 20	18 to 20	1.8 to 2.1	13 to 15	30 to 34	3.0 to 3.5	22 to 25
M10	40 to 45	4.0 to 4.6	29 to 33	32 to 34	3.2 to 3.5	24 to 25	48 to 55	4.9 to 5.7	36 to 41	40 to 44	4.0 to 4.5	29 to 32	61 to 70	6.2 to 7.2	45 to 52
M12	63 to 72	6.4 to 7.4	47 to 53	—	—	—	78 to 90	7.9 to 9.2	58 to 66	63 to 72	6.4 to 7.4	47 to 53	103 to 117	10.5 to 12.0	76.0 to 86.7
M14	108 to 125	11.0 to 12.8	79.6 to 92.5	—	—	—	124 to 147	12.6 to 15.0	91.2 to 108	—	—	—	167 to 196	17.0 to 20.0	123 to 144
M16	167 to 191	17.0 to 19.5	123 to 141	—	—	—	197 to 225	20.0 to 23.0	145 to 166	—	—	—	260 to 304	26.5 to 31.0	192 to 224
M18	246 to 284	25.0 to 29.0	181 to 209	—	—	—	275 to 318	28.0 to 32.5	203 to 235	—	—	—	344 to 402	35.0 to 41.0	254 to 296
M20	334 to 392	34.0 to 40.0	246 to 289	—	—	—	368 to 431	37.5 to 44.0	272 to 318	—	—	—	491 to 568	50.0 to 58.0	362 to 419

2. Stud bolts tightening torque

Material	Steel			Aluminum		
Units	N · m	kgf · m	lbf · ft	N · m	kgf · m	lbf · ft
M8	12 to 15	1.2 to 1.6	8.7 to 11	8.9 to 11	0.90 to 1.2	6.5 to 8.6
M10	25 to 31	2.5 to 3.2	18 to 23	20 to 25	2.0 to 2.6	15 to 18
M12	30 to 49	3.0 to 5.0	22 to 36	31	3.2	23
M14	62 to 73	6.3 to 7.5	46 to 54	—	—	—
M16	98.1 to 112	10.0 to 11.5	72.4 to 83.1	—	—	—
M18	172 to 201	17.5 to 20.5	127 to 148	—	—	—

3. Hydraulic hose fitting tightening torque

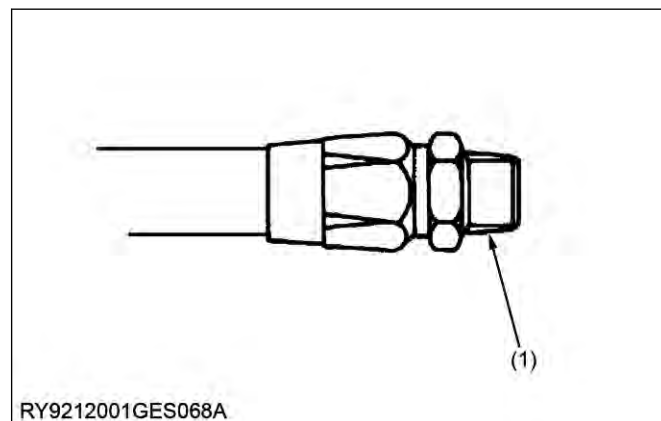


(1) Union nut

Units	N · m	kgf · m	lbf · ft
1/8	7.8 to 11.8	0.8 to 1.2	5.8 to 8.7
1/4	24.5 to 29.2	2.5 to 3.0	18.1 to 21.5
3/8	37.2 to 42.1	3.8 to 4.3	27.5 to 31.0
1/2	58.8 to 63.7	6.0 to 6.5	43.4 to 46.9
3/4	117.6 to 127.4	12.0 to 13.0	86.7 to 94.0
1	181.3 to 191.1	18.5 to 19.5	133.8 to 140.9
1-1/4	220.5 to 230.3	22.5 to 23.5	162.8 to 170.0

Units	N · m	kgf · m	lbf · ft
9/16-18 (ORS type)	35.2 to 43.1	3.6 to 4.4	26.0 to 31.8
11/16-16 (ORS type)	60.0 to 73.5	6.0 to 7.5	44.3 to 54.2
13/16-16 (ORS type)	70.6 to 86.2	7.2 to 8.8	52.1 to 63.6
1-14 (ORS type)	105.8 to 129.4	10.8 to 13.2	78.0 to 98.4

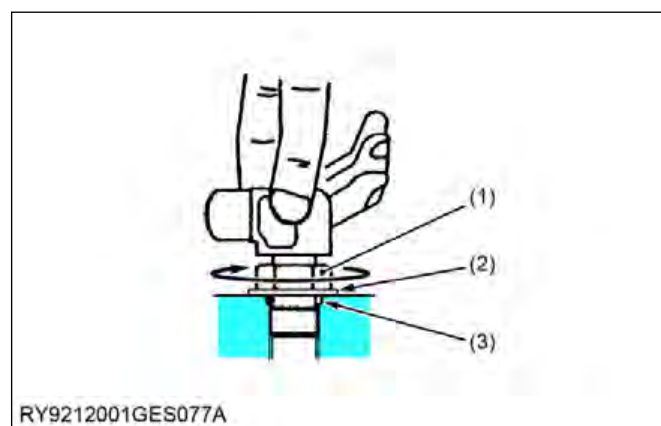
4. Hydraulic hoses tightening torque (taper thread)



(1) Taper thread

Units	N · m	kgf · m	lbf · ft
1/8	19.6 to 29.4	2.0 to 3.0	14.5 to 21.6
1/4	36.6 to 44.1	3.7 to 4.5	27.0 to 32.5
3/8	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
1/2	83.4 to 88.3	8.5 to 9.0	61.6 to 65.1
3/4	166.6 to 181.3	17.0 to 18.5	122.9 to 133.7

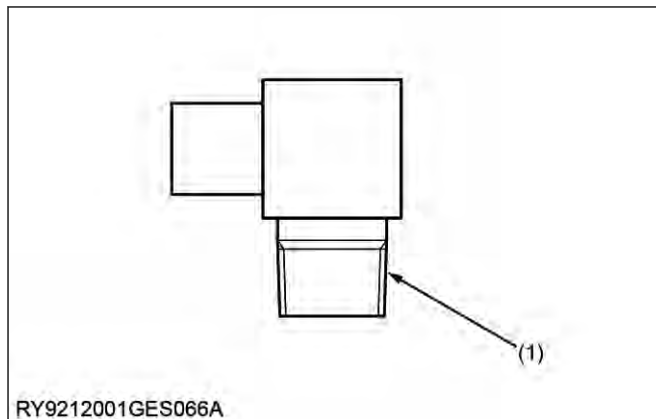
5. Locknuts of adapters with O-ring tightening torque (straight thread)

(1) Locknut
(2) Seat

(3) Seal (O-ring)

Units	N · m	kgf · m	lbf · ft
1/8	15.0 to 16.5	1.5 to 1.7	11.1 to 12.1
1/4	24.5 to 29.4	2.5 to 3.0	18.1 to 21.5
3/8	49.0 to 53.9	5.0 to 5.5	36.2 to 39.7
1/2	58.8 to 63.7	6.0 to 6.5	43.4 to 46.9
3/4, 1	117.6 to 127.4	12.0 to 13.0	86.74 to 93.96
1-1/4	220.5 to 230.3	22.5 to 23.5	162.7 to 169.8

6. Adapters tightening torque (taper thread)

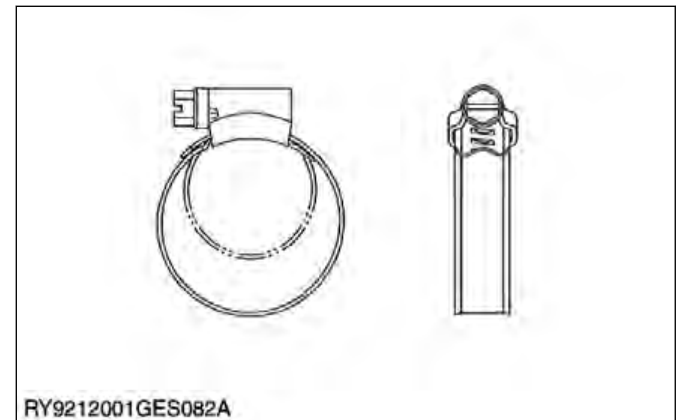


(1) Taper thread

Units	N · m	kgf · m	lbf · ft
1/8	19.6 to 29.4	2.0 to 3.0	14.5 to 21.6
1/4	36.3 to 44.1	3.7 to 4.5	27.0 to 32.5
3/8	68.6 to 73.5	7.0 to 7.5	50.6 to 54.2
1/2	83.4 to 88.3	8.5 to 9.0	61.6 to 65.1
3/4	166.6 to 181.3	17.0 to 18.5	122.9 to 133.7

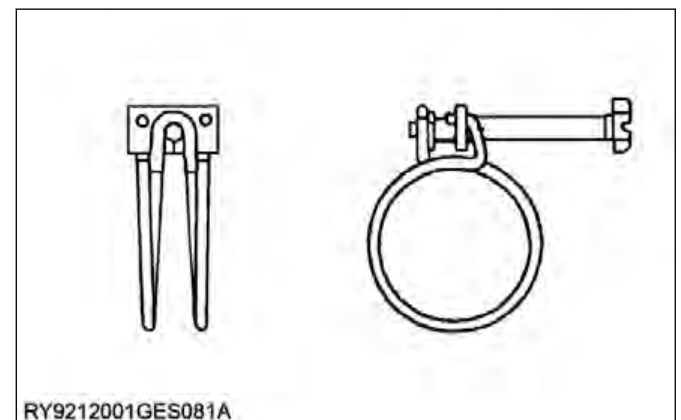
7. Hose clamps tightening torque

Steel band type



Units	N · m	kgf · cm	lbf · ft
φ13-φ20	2.5 to 3.4	25 to 35	1.9 to 2.5
φ15-φ25	4.9 to 5.9	50 to 60	3.7 to 4.3
φ19-φ28			
φ22-φ32			
φ26-φ38			
φ32-φ44			
φ44-φ56			
φ50-φ65			
φ58-φ75			
φ60-φ80			
φ68-φ85			
φ77-φ95			

Wire band type

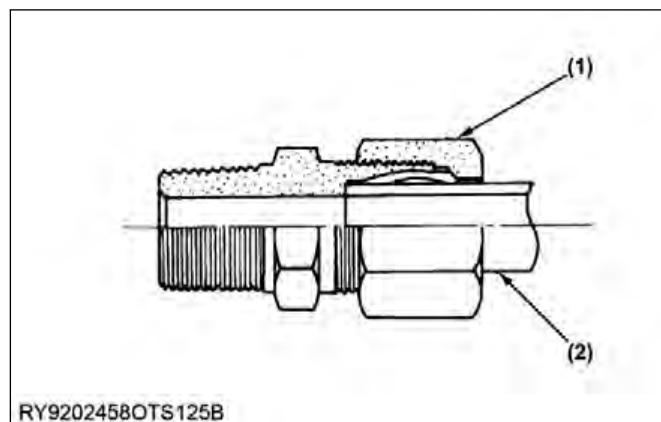


Units	N · m	kgf · cm	lbf · ft
φ10-φ14	2.5 to 3.4	25 to 35	1.9 to 2.5

(Continued)

Units	N · m	kgf · cm	lbf · ft
φ12-φ16	2.5 to 3.4	25 to 35	1.9 to 2.5
φ19-φ25			
φ31-φ40			
φ36-φ46			
φ44-φ53	3.9 to 4.9	40 to 50	2.9 to 3.6
φ51-φ59			
φ86-φ96	2.5 to 3.4	25 to 35	1.9 to 2.5

8. Hydraulic pipe tightening torque



(1) Union nut

(2) Pipe

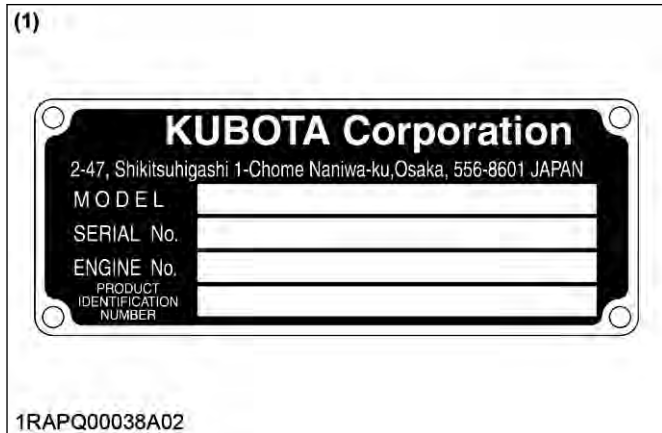
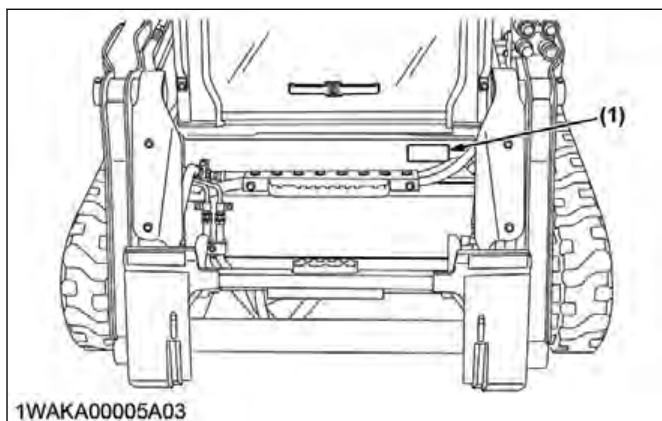
Units	N · m	kgf · m	lbf · ft
M8 × 1.0	29.4 to 39.2	3.0 to 4.0	21.7 to 28.9
M10 × 1.0	39.2 to 44.1	4.0 to 4.5	28.9 to 32.5
M12 × 1.5	53.9 to 63.7	5.5 to 6.5	39.8 to 31.0
M16 × 2.0	88.3 to 98.1	6.0 to 6.5	43.4 to 47.0
M18 × 2.0	127.5 to 137.5	13.0 to 14.0	94.0 to 101.4
M20 × 1.6	147.0 to 156.8	15.0 to 16.0	108.4 to 115.7

GENERAL MACHINE INFORMATION

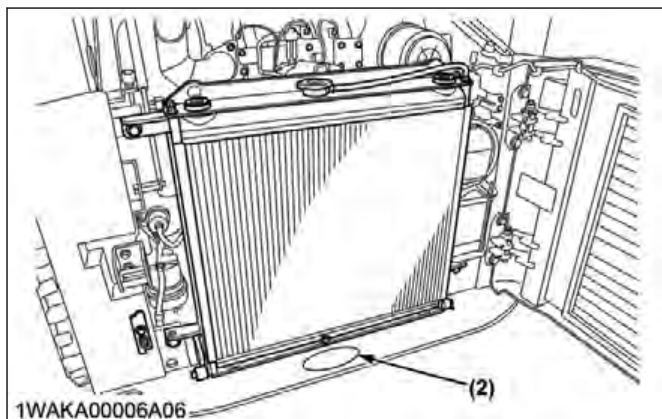
1. Machine model identification

■ IMPORTANT

- Before contacting customer support, note the loader model, serial number, engine type, engine serial number, and hour meter indication.



(1) Name plate

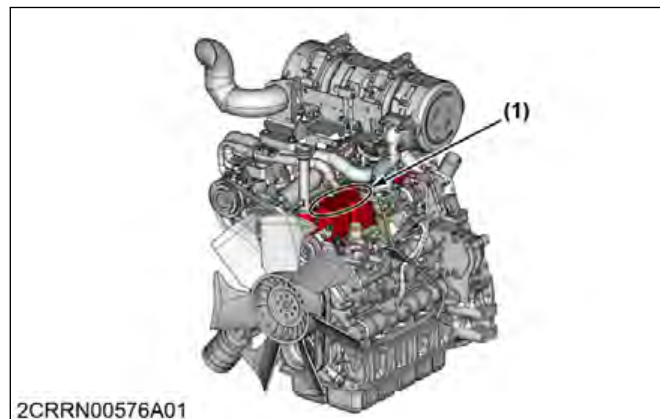


(2) Machine serial number

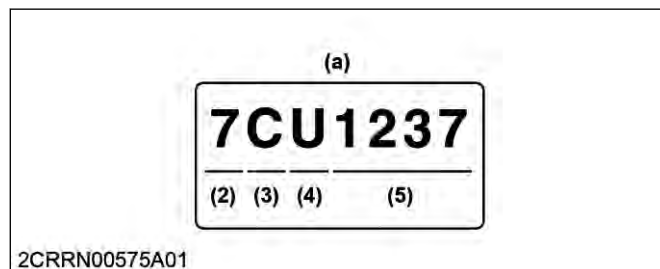
2. Engine model identification

■ IMPORTANT

- Before contacting customer support, take a note the loader model, serial number, engine type, engine serial number, and hour meter.



(1) Engine model and serial number label



(2) Engine series

(3) Production year

(4) Production month

(5) Lot number

(a) Engine serial number

Engine serial number

The engine serial number identifies the engine series, production year, production month, and lot number.

2. GENERAL

GENERAL MACHINE INFORMATION

3. Muffler model identification

Engine series

Number or letter	Series
1	05 (include: WG)
2	V3
3	08
4	SM (include: WG)
5	Air-cooled gasoline
6	GZ, OC, AC, EA, E
7	03
8	07
A	EA, RK
B	03 (KET production)

Production year

Number or letter	Year	Number or letter	Year
1	2001	F	2015
2	2002	G	2016
3	2003	H	2017
4	2004	J	2018
5	2005	K	2019
6	2006	L	2020
7	2007	M	2021
8	2008	N	2022
9	2009	P	2023
A	2010	R	2024
B	2011	S	2025
C	2012	T	2026
D	2013	V	2027
E	2014		

Production month and lot number

Month	Lot number	
January	A0001 to A9999	From B0001
February	C0001 to C9999	From D0001
March	E0001 to E9999	From F0001
April	G0001 to G9999	From H0001
May	J0001 to J9999	From K0001
June	L0001 to L9999	From M0001
July	N0001 to N9999	From P0001
August	Q0001 to Q9999	From R0001
September	S0001 to S9999	From T0001

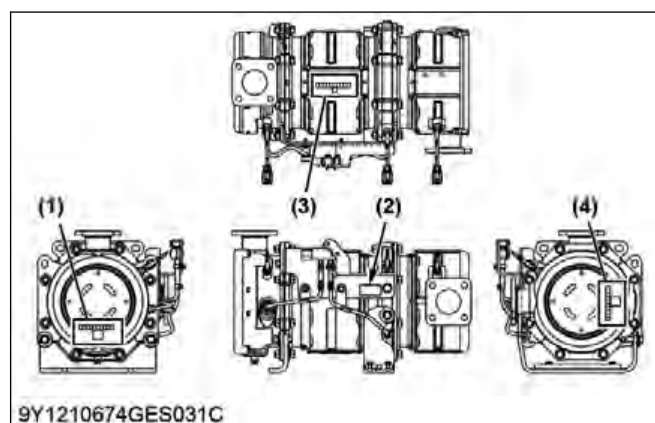
(Continued)

Month	Lot number	
October	U0001 to U9999	From V0001
November	W0001 to W9999	From X0001
December	Y0001 to Y9999	From Z0001

3. Muffler model identification

■ IMPORTANT

- Before replacing or disassembling the DPF or DOC, take a note the part number and serial number.



- | | |
|---|---------------------------------------|
| (1) Muffler assembly part number and serial number | (3) DPF part number and serial number |
| (2) DPF muffler full assembly part number and serial number | (4) DOC part number and serial number |

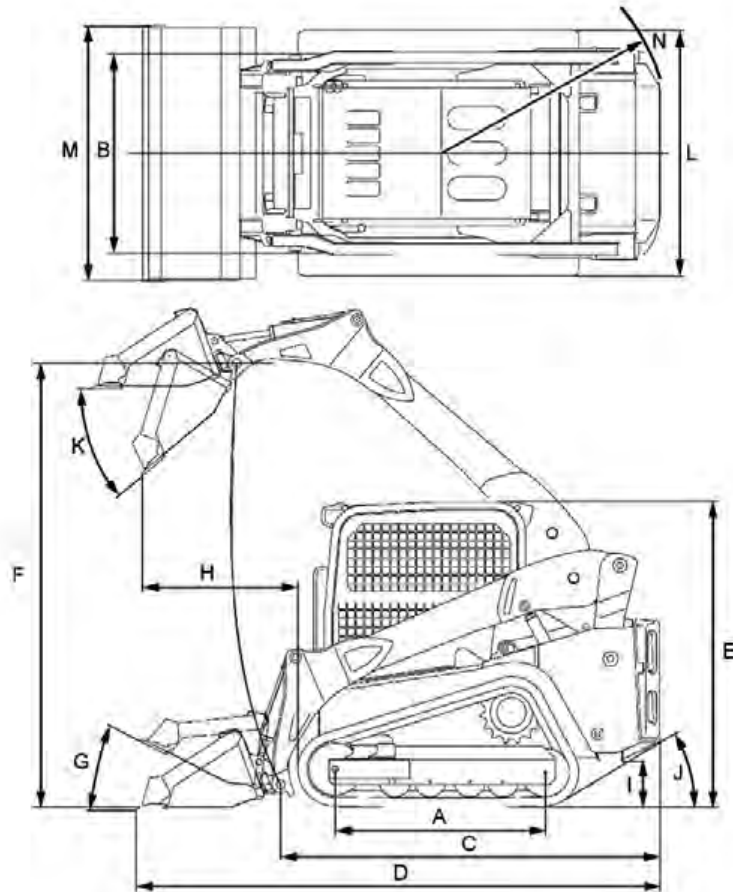
4. Specifications

Model			SVL65-2	
Type			Open Cab	Closed Cab
Operating weight including operator's weight			3645 kg 8035 lbs	3840 kg 8465 lbs
Engine	Type		Water cooled 4 cycle diesel engine with 4 cylinder EPA Tier 4	
	Model name		V2607-CR-TE4-CTL	V2607-CR-TE4-CTL-Q
	Total displacement		2615 cc 159.6 cu.in.	
	Engine power	SAE J1995 gross	51 kW 68.4 HP	
		SAE J1349 net	44.7 kW 55.9 HP	
	Rated speed		2600 rpm	
	Low idling speed		1250 rpm	
Performance	Rated operating capacity		953 kg 2100 lbs	
	Tipping load		2722 kg 6000 lbs	
	Breakout force	Bucket	2093 kg 4614 lbs	
		Lift arm	1935 kg 4266 lbs	
	Travel speed	Fast	11.5 km/h 7.1 mph	
		Slow	7.8 km/h 4.9 mph	
	Ground pressure (with operator)		Standard tracks	Wide tracks
			34.0 kPa 0.35 kgf/cm ² 4.9 psi	30.1 kPa 0.31 kgf/cm ² 4.4 psi
Battery capacity			12 V RC: 160 min, CCA 900 A	
Pressure connection for attachments	MAX displacement (theoretical)		Normal flow	High-flow
			65.8 L/min 17.4 U.S.gals/min	102.2 L/min 27.0 U.S.gals/min
	MAX pressure		22.5 MPa 230 kgf/cm ² 3271 psi	
Fuel tank capacity			82 L 21.7 U.S.gals	

NOTE

- Specifications are based on the machine with the standard bucket.
- Specifications are subject to change without notice.

5. Machine dimensions



1RAPQ00157A01

Model		SVL65-2	
		Standard tracks	Wide tracks
A	Length of a track on the ground	1470 mm 57.9 in.	
B	Track gauge	1337 mm 52.6 in.	
C	Length w/o bucket	2725 mm 107.3 in.	
D	Length w/bucket on the ground	3465 mm 136.4 in.	
E	Height to the top of the cab	2029 mm 79.9 in.	
F	Bucket hinge pin height at the MAX lift	3010 mm 118.5 in.	
G	Rollback angle at carry position	30 degree	
H	Reach at MAX lift and dump	886 mm 34.9 in.	
I	Ground clearance	233 mm 9.1 in.	
J	Departure angle	30 degree	
K	MAX dump angle	40 degree	
L	Vehicle width	1657 mm 65.2 in.	1717 mm 67.6 in.
M	Width with bucket	1776 mm 68 in.	1880 mm 74 in.
N	Turning radius from the center to the rear of the machine	1451 mm 57.1 in.	

6. Machine mass table

NOTE

- Mass values described here are reference values based on actual measured values (marked with @) and drawing values.

Parts	Mass	Remarks
Front attachment	Lift arm	371 kg 818 lbs @
	Bucket (standard)	216 kg 476 lbs —
	Bucket (wide)	229 kg 505 lbs —
	Lift arm link	27 kg 60 lbs @
	Mechanical quick hitch	60 kg 132 lbs —
	Hydraulic quick hitch	70 kg 155 lbs @
	Lift arm cylinder	24 kg 53 lbs @
	Bucket cylinder	16 kg 35 lbs @
	Hydraulic quick hitch cylinder	7.5 kg 17 lbs @
Engine	Engine	316 kg 697 lbs @
	DPF muffler	26 kg 57 lbs @
Hydraulic device	Radiator	42 kg 93 lbs @
	HST pump	70 kg 154 lbs @ Including the adapters and coupling
	HST motor	62 kg 137 lbs @ Including the adapters
	Gear pump (normal flow)	7 kg 15 lbs —
	Gear pump (high-flow)	14 kg 31 lbs @ Including the adapters
	Control valve	38 kg 84 lbs @ Including the adapters
	Hydraulic tank	13 kg 29 lbs —
Machine body	Open cab	210 kg 463 lbs —
	Closed cab	312 kg 688 lbs @ Including the air conditioning system

(Continued)

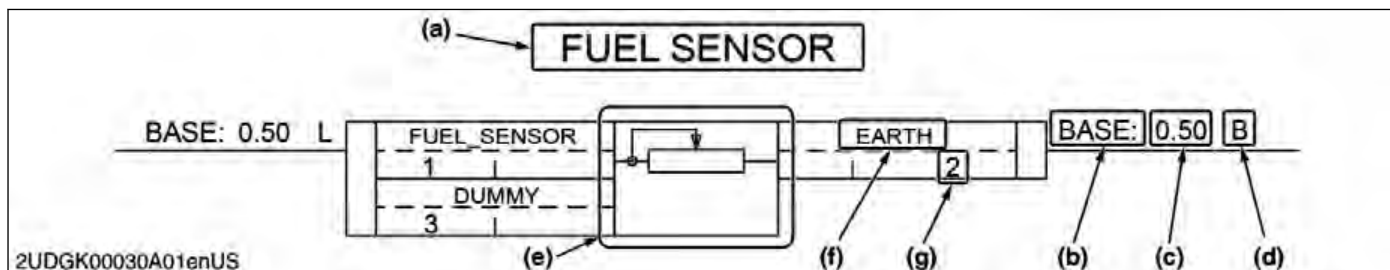
Parts		Mass	Remarks
Machine body	Standard rubber track	161 kg 355 lbs	@
	Wide rubber track	176 kg 388 lbs	—
	Front idler	64 kg 141 lbs	@ Including the tension spring
	Rear idler	33 kg 73 lbs	@
	Track roller	26 kg 58 lbs	@
	Grease cylinder	6.5 kg 14.3 lbs	@

2. GENERAL

GENERAL ELECTRICAL INFORMATION

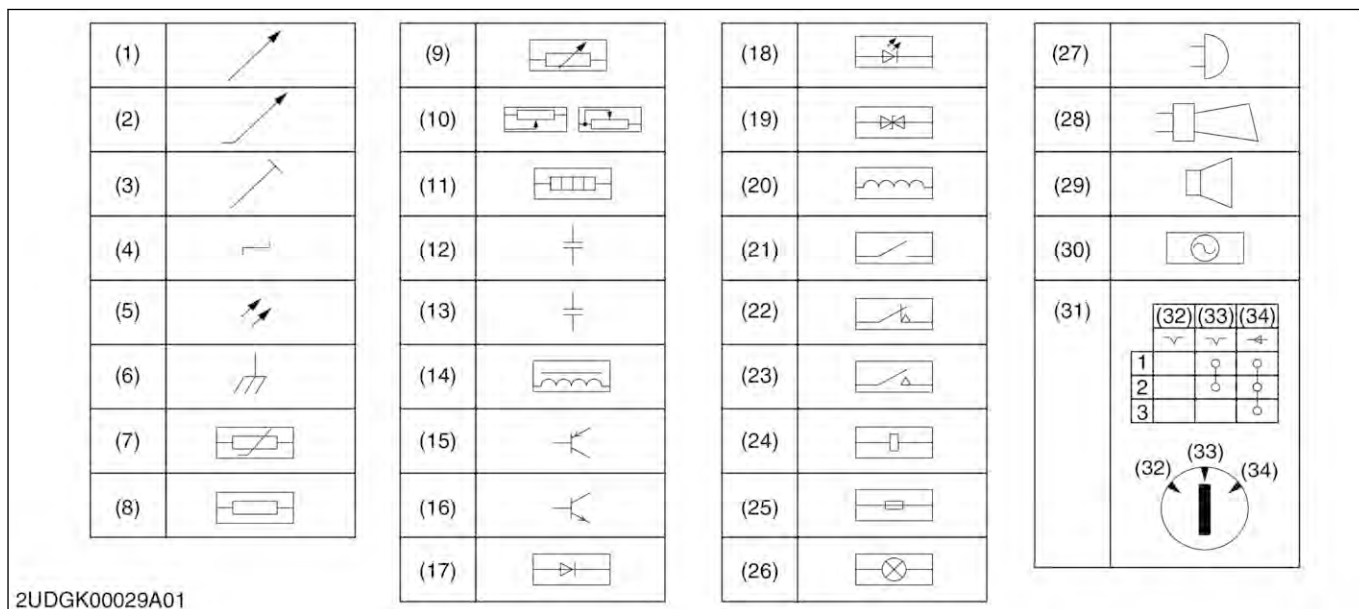
1. Electrical circuit general description

1.1 Electrical circuit diagram description



- | | | | |
|------------------------|----------------------------|-----------------|----------------|
| (a) Part name | (c) Electrical wiring size | (e) Unit symbol | (g) Pin number |
| (b) Specification code | (d) Wiring color coding | (f) Pin name | |

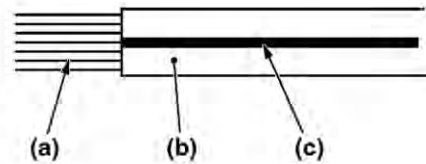
1.2 Electrical circuit diagram unit symbol



- | | | | |
|---|---------------------------------|--|---------------------|
| (1) Variable | (11) Heating element | (22) Auto-resetting NC (normally closed) | (31) Starter switch |
| (2) Nonlinear variable | (12) Capacitor | (23) Auto-resetting NO (normally open) | (32) STOP |
| (3) Fixed setting | (13) Electrolytic capacitor | (24) Relay coil | (33) RUN |
| (4) Step variable | (14) Magnetic core inductance | (25) Fuse | (34) START |
| (5) Non-ionizing radiation (NIR) | (15) PNP transistor | (26) Lamp | |
| (6) Body GND | (16) NPN transistor | (27) Buzzer | |
| (7) Thermistor | (17) Semiconductor diode | (28) Horn | |
| (8) Resistor | (18) Light-emitting diode (LED) | (29) Speaker | |
| (9) Variable resistor | (19) Two-way breakdown diode | (30) AC voltage source | |
| (10) Potentiometer with sliding contact | (20) Coil | | |
| | (21) NO (normally open) | | |

1.3 Electrical wiring color coding

Wiring color	Color code	Wiring color	Color code
Black	B	Blue/Green	L/G
Green	G	Blue/Orange	L/O
Blue	L	Blue/Red	L/R
Pink	P	Blue/White	L/W
Red	R	Blue/Yellow	L/Y
White	W	Yellowish green/Blue	LG/L
Yellow	Y	Yellowish green/Red	LG/R
Brown	BR	Yellowish green/White	LG/W
Gray	GR	Yellowish green/Yellow	LG/Y
Yellowish green	LG	Orange/White	O/W
Orange	O	Pink/White	P/W
Light blue	SB	Pink/Blue	P/L
Black/Green	B/G	Red/Black	R/B
Black/Blue	B/L	Red/Green	R/G
Black/Pink	B/P	Red/Blue	R/L
Black/Violet	B/V	Red/White	R/W
Black/Red	B/R	Red/Yellow	R/Y
Black/White	B/W	Violet/White	V/W
Black/Yellow	B/Y	White/Black	W/B
Brown/Black	BR/B	White/Green	W/G
Brown/Yellow	BR/Y	White/Blue	W/L
Brown/Red	BR/R	White/Red	W/R
Green/Black	G/B	White/Yellow	W/Y
Green/Blue	G/L	Yellow/Black	Y/B
Green/Red	G/R	Yellow/Green	Y/G
Green/White	G/W	Yellow/Blue	Y/L
Green/Yellow	G/Y	Yellow/Red	Y/R
Blue/Black	L/B		

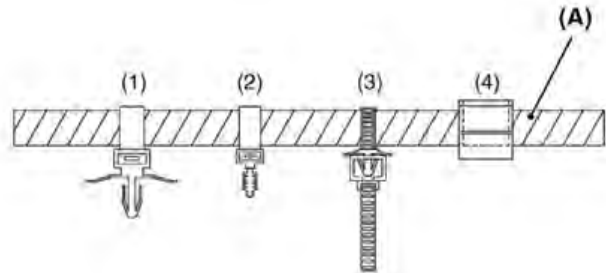


RY9212324ELM002A

- (a) Electric wiring size (mm²) (c) Stripe color
(b) Base color

- 1.25-Y/R
- 1.25 mm² (electric wiring size)
Y: Yellow (base color)
R: Red (stripe color)

1.4 Electrical wiring clamp

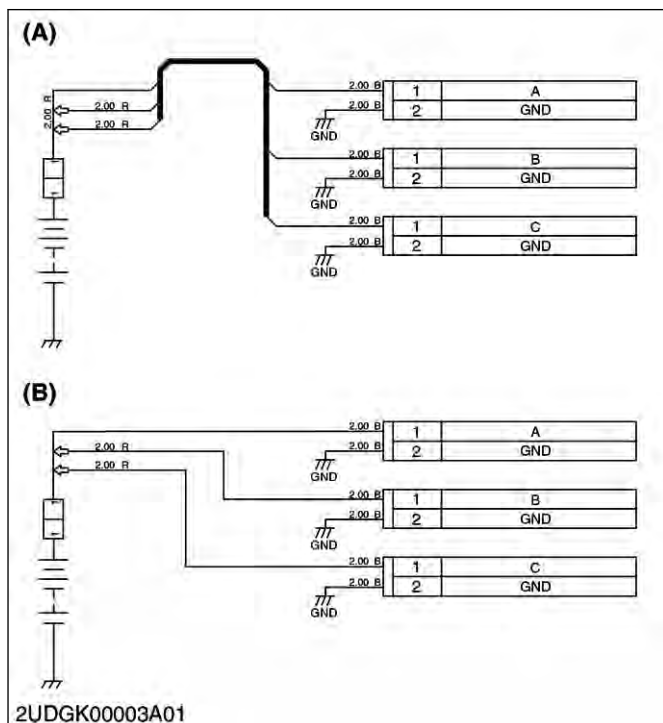


RY9212324ELM003B

- (1) Anchor type (insert to the anchor)
(2) Screw type (insert to the screw end)
(3) Plug-in type (insert until it locks)
(4) Plug-in type (insert until it locks)
(A) Wire harness

1.5 Bus description

Bus simplifies complex circuits with many branches.

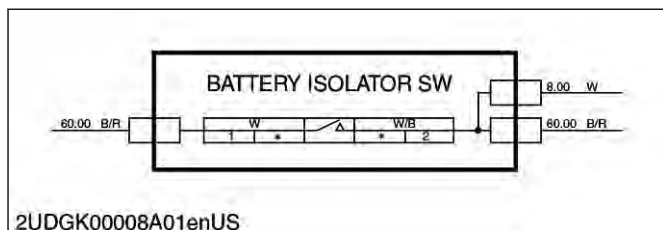


(A) Diagram with bus

(B) Diagram without bus

1.6 Composite terminal description

Connects 2 or more terminals together to a device.



2. Connector

2.1 Connector handling precaution

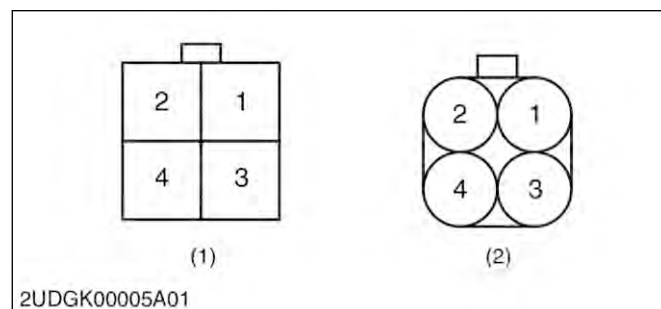
■ IMPORTANT

- When disconnecting a connector, grasp the connector to pull it out. Do not pull the wiring.
- When disconnecting a locking type connector, release the lock and pull it out.
- When removing the waterproof plastic cover of the connector, do not allow water to enter the connector.
- Repair any connector terminal deformations. Ensure that there is no protruding, loose, or rusty wiring.
- Ensure that the locking type connector is locked when inserted.

2.2 Connector diagram description

Fewer than 10 pins

Female

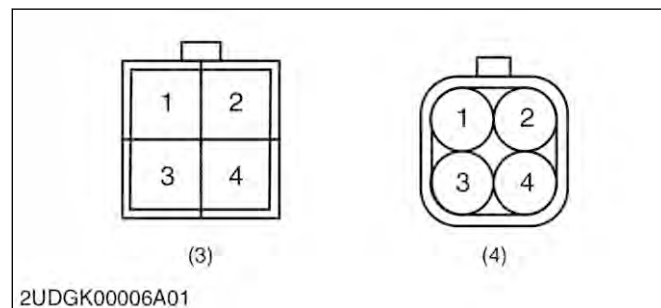


(1) Non-waterproof

(2) Waterproof

- Numbers are arranged from the top right.
- Number 1 is located on the top right.

Male



(3) Non-waterproof

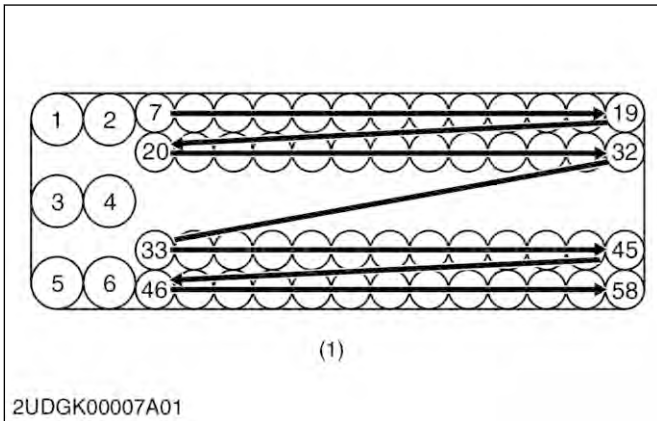
(4) Waterproofed

- Numbers are arranged from the top left.
- Number 1 is located on the top left.

2. GENERAL

More than 11 pins

Female



(1) Main ECU connector (female)

TRANSPORTING THE MACHINE

1. Loading and unloading the machine on a truck

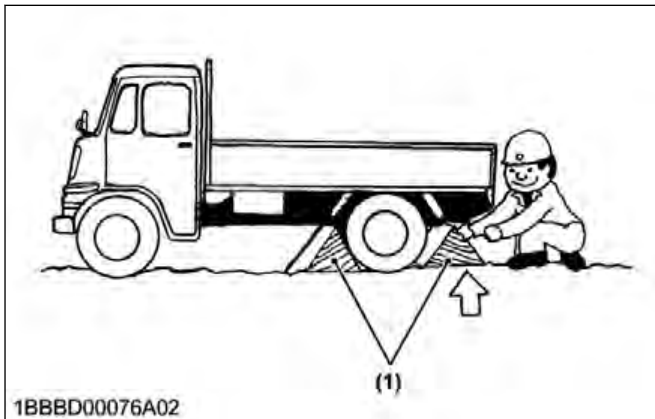


DANGER

- Do not use a wet loading ramp. The machine may fall from the loading ramp.
- Do not operate the steering wheel or front attachment while loading or unloading the machine. The machine may fall from the loading ramp.
- Do not operate the machine with high speed while loading or unloading the machine.

Preparing

1. Park the truck on the firm and level ground and stop the engine.
2. Set wheel stoppers.



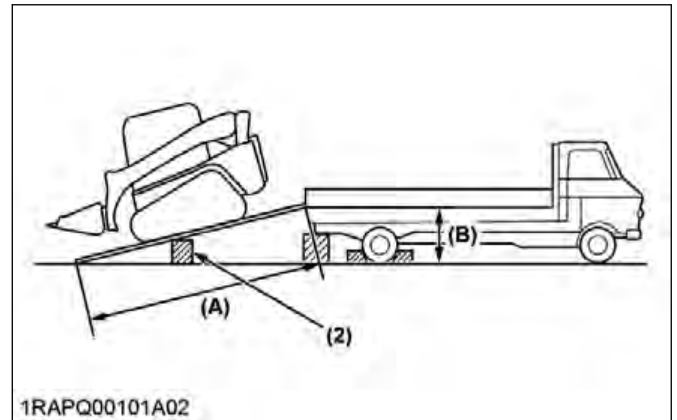
(1) Wheel stoppers

Loading

1. Set a ramp securely.
2. Set a support block under the loading ramp to prevent the front of the truck from being lifted by the machine weight.
3. Travel the machine backwards with low speed to load the machine.

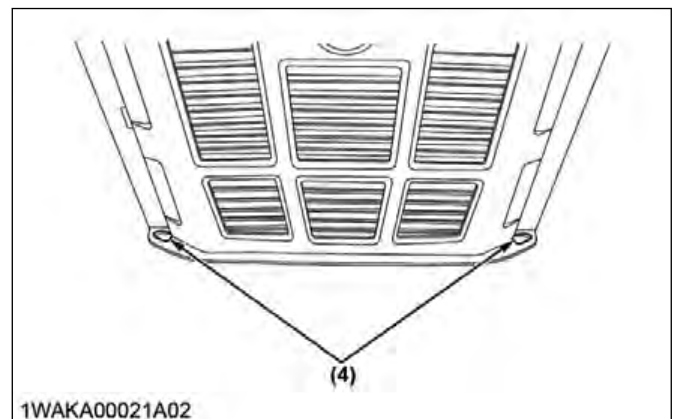
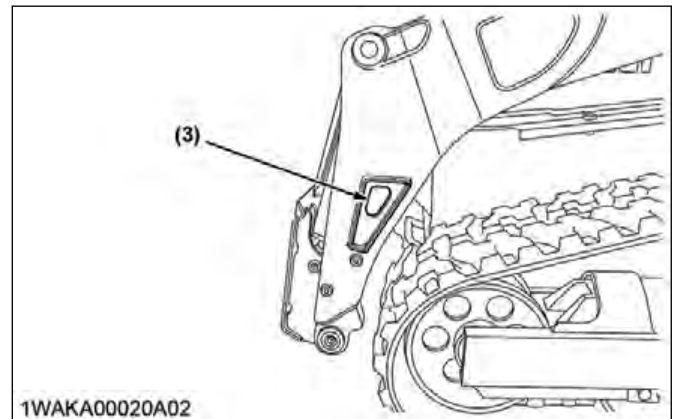
NOTE

- Make sure to position the bucket not to hit the ground or loading ramp.



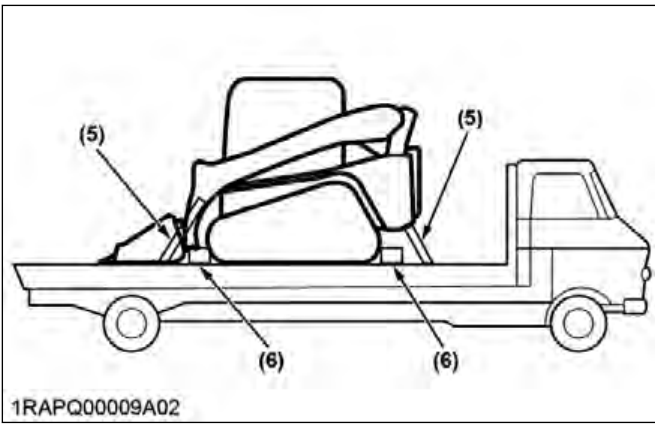
(2) Support block
(A) 4 times or more of the bed height
(B) Bed height

4. After loading the machine on the truck bed, lower the bucket to the bed.
5. Stop the engine and remove the key.
6. Tie down the machine at 4 tie-down points.



(3) Front tie-down points
(4) Rear tie-down points

7. Set wheel stoppers.



(5) Nylon slings (6) Wheel stoppers

8. Keep the machine locked with the nylon slings during transportation.

■ NOTE

- Drive the truck carefully to prevent the machine from moving during transportation.

Unloading

1. Start the engine.
2. Operate the machine forwards with low speed to unload the machine.

■ NOTE

- Make sure to position the bucket not to hit the ground or loading ramp.

2. Towing the inoperable machine

■ IMPORTANT

- Tow only with the rear tie down points.
- Do not tow for a long distance.
- Tow at walking speed.
- Use a tow chain or rope that is capable of towing an object 1.5 times heavier than the machine.
- Towing should only be carried out by trained or licensed personnel.

1. Set wheel stoppers at the both sides, front and rear.

⚠ CAUTION

- Since the machine can move freely after removing the sun gears of the HST motor, securely lock the tracks with wheel stoppers.

2. Remove the drain plug to drain the gear oil from the HST motor.



(1) HST motor (2) Drain port

3. Remove the 8 bolts from the HST motor.



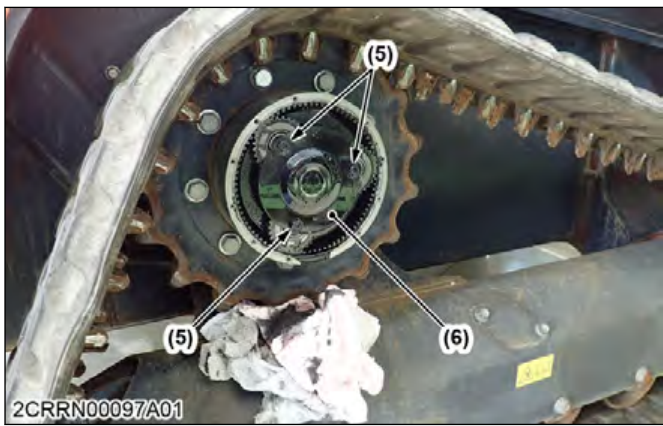
(3) Bolt (M6 × 25) × 8

4. Remove the cover.



(4) Cover

5. Remove the 3 bolts to remove the plate.



(5) Bolt (M8 × 20) × 3

(6) Plate

6. Remove the sun gear.



(7) Sun gear

7. Install the plate.



(6) Plate

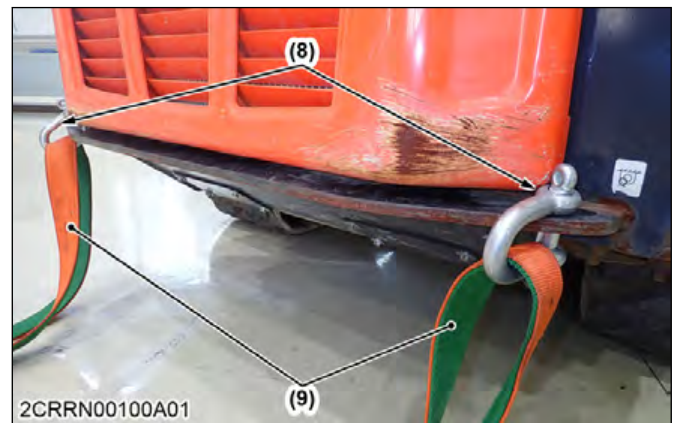
8. Install the cover.



(4) Cover

9. Repeat the above procedure on the HST motor on the opposite side.

10. Install 2 shackles to the rear tie down points and attach chain or rope to the shackles.



(8) Shackle

(9) Rope

11. Tow the machine at walking speed.



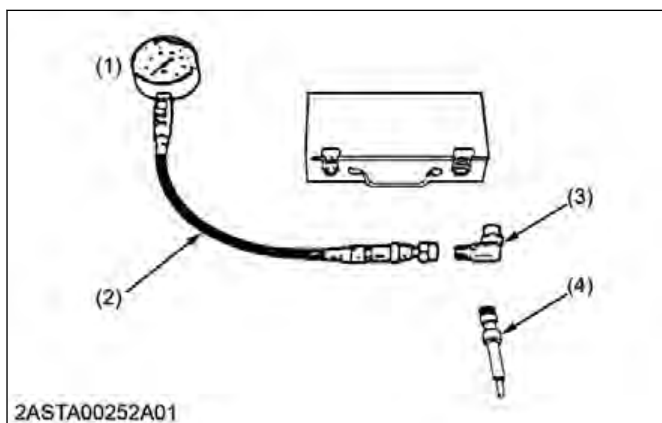
■ IMPORTANT

- Install the sun gears and replenish the gear oil after towing.

SPECIAL JIGS AND TOOLS

1. Engine compression pressure measuring kit

Diesel engine compression tester



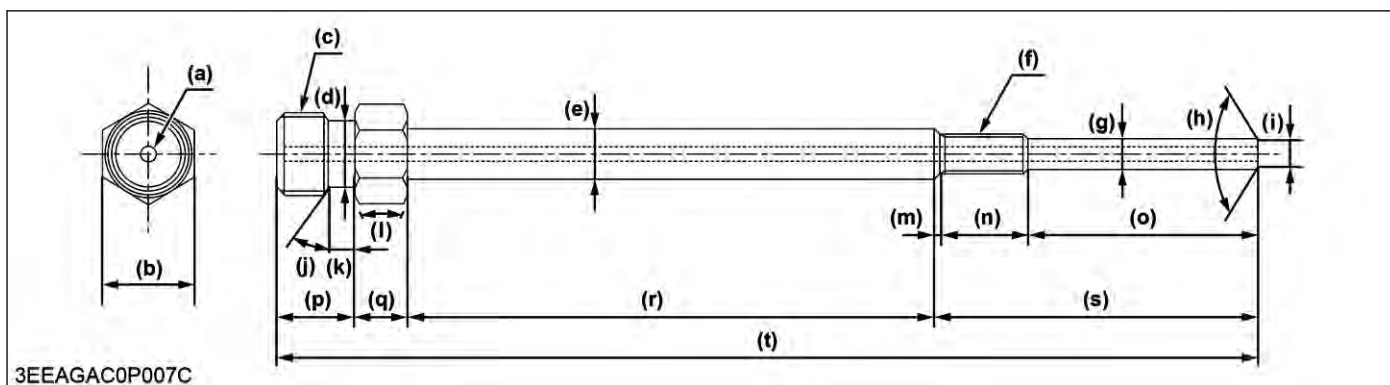
(1) Pressure gauge

(2) Hose assembly

(3) L joint

(4) Adapter

Adapter

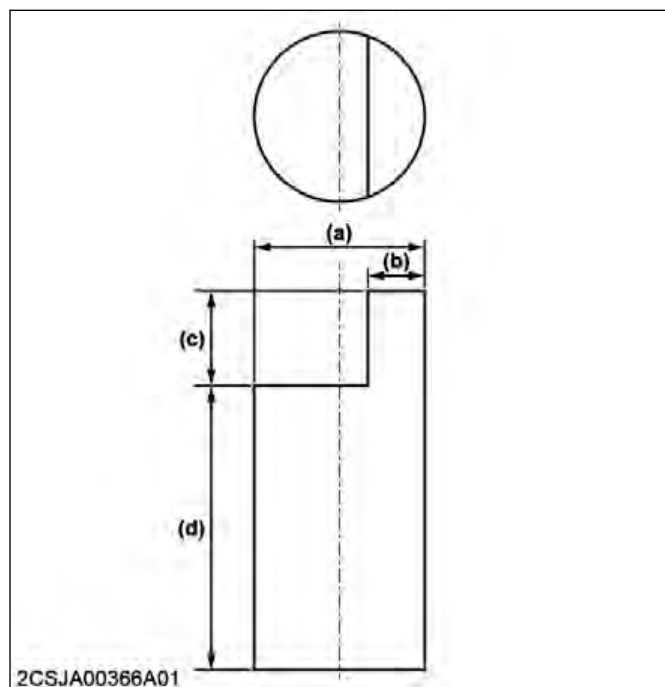


2. GENERAL

	Dimension
(a)	φ3.0 mm drill φ0.10 in. drill
(b)	17.0 mm 0.67 in.
(c)	16.0 mm 0.63 in.
(d)	φ13 mm φ0.51 in.
(e)	φ9.5 mm φ0.37 in.
(f)	M8 × P1.0
(g)	φ6.50 to 6.70 mm φ0.25 to 0.26 in.
(h)	2.12 to 2.18 rad 121 to 125°
(i)	φ4.90 to 5.50 mm φ0.19 to 0.22 in.
(j)	0.52 rad 30°
(k)	5.0 mm 0.20 in.
(l)	1.0 rad 60°
(m)	1.0 mm 0.04 in.
(n)	17.0 mm 0.67 in.
(o)	47.0 mm 1.85 in.
(p)	15.0 mm 0.59 in.
(q)	10.0 mm 0.39 in.
(r)	100 mm 3.94 in.
(s)	65.0 mm 2.56 in.
(t)	190 mm 7.48 in.
Material	SS400

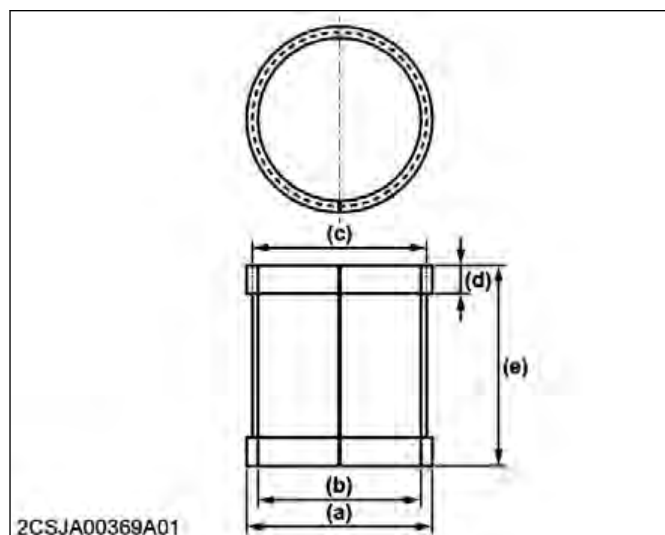
2. Hydraulic cylinder special jigs

U-ring installation jig



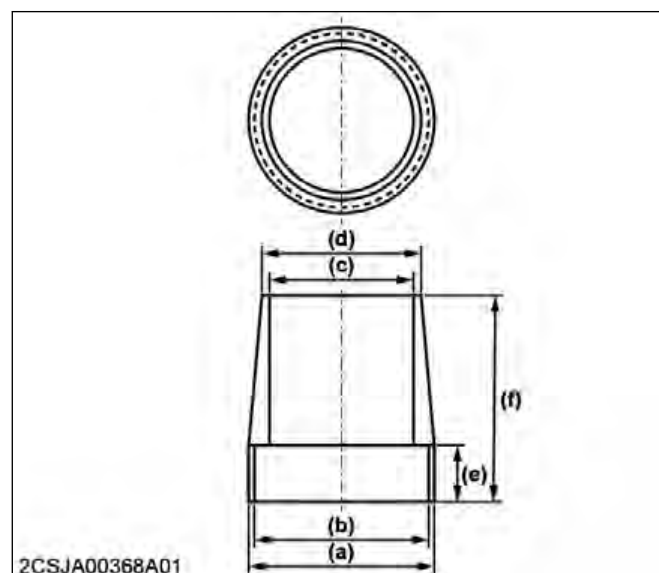
	Dimension
(a)	φ40 mm φ1.6 in.
(b)	15 mm 0.59 in.
(c)	25 mm 0.98 in.
(d)	75 mm 2.95 in.
Material	MC nylon

Seal ring installation jig 1

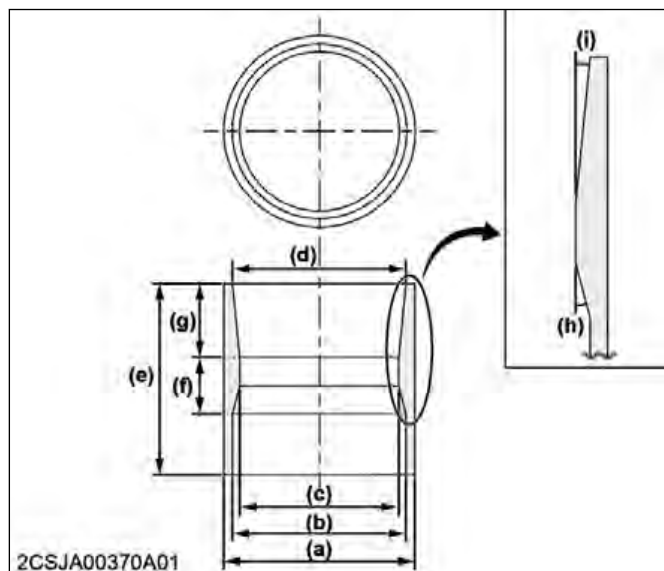


	Dimension
(a)	φ67.0 mm φ2.64 in.
(b)	φ60.0 mm φ2.36 in.
(c)	φ64.0 mm φ2.52 in.
(d)	10 mm 0.39 in.
(e)	72 mm 2.83 in.
Material	MC nylon

Seal ring installation jig 2



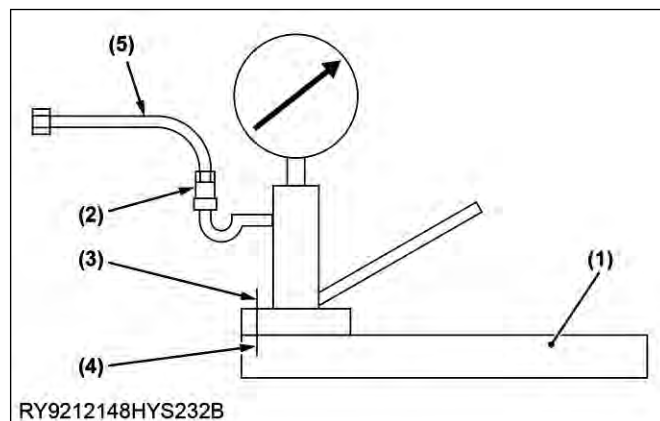
	Dimension
(a)	φ65.7 mm φ2.6 in.
(b)	φ64.6 mm φ2.54 in.
(c)	φ50 mm φ2.0 in.
(d)	φ55.7 mm φ2.19 in.
(e)	10 mm 0.39 in.
(f)	72 mm 2.83 in.
Material	S45C

Seal ring correction jig

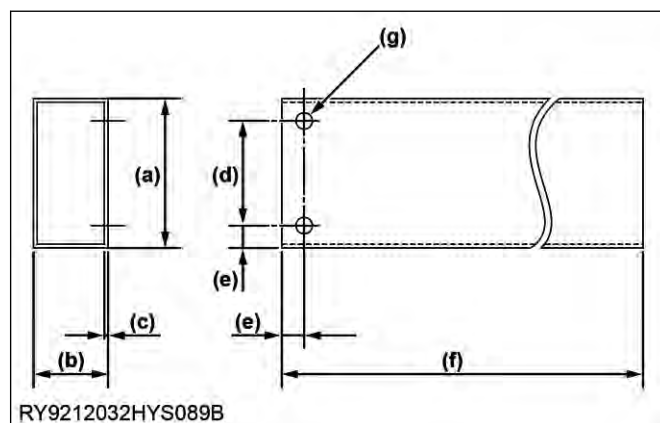
	Dimension
(a)	φ75 mm φ3.0 in.
(b)	φ68 mm φ2.7 in.
(c)	φ65 mm φ2.6 in.
(d)	φ71.3 mm φ2.81 in.
(e)	78 mm 3.07 in.
(f)	23 mm 0.91 in.
(g)	30 mm 1.2 in.
(h)	15°
(i)	6°
Material	S45C

3. Overload relief valve measuring kit**CAUTION**

- When measuring overload relief pressure, use a test hose which has enough pressure endurance.

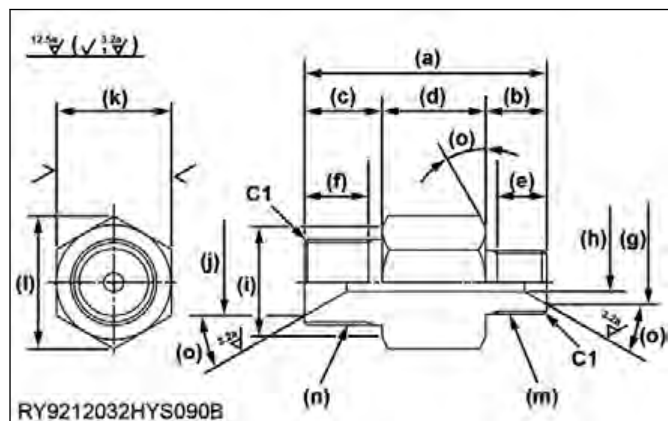
Nozzle tester

- (1) Support (4) Nut (M12) ×2
 (2) Pipe fittings (M12-G1/4) (5) Test hose
 (3) Bolt (M10 × 35) ×2

Support

	Dimension
(a)	100 mm 3.94 in.
(b)	50 mm 1.97 in.
(c)	2.3 mm 0.09 in.
(d)	70 mm 2.76 in.
(e)	15 mm 0.59 in.
(f)	600 mm 23.62 in.
(g)	11 mm 0.43 in.

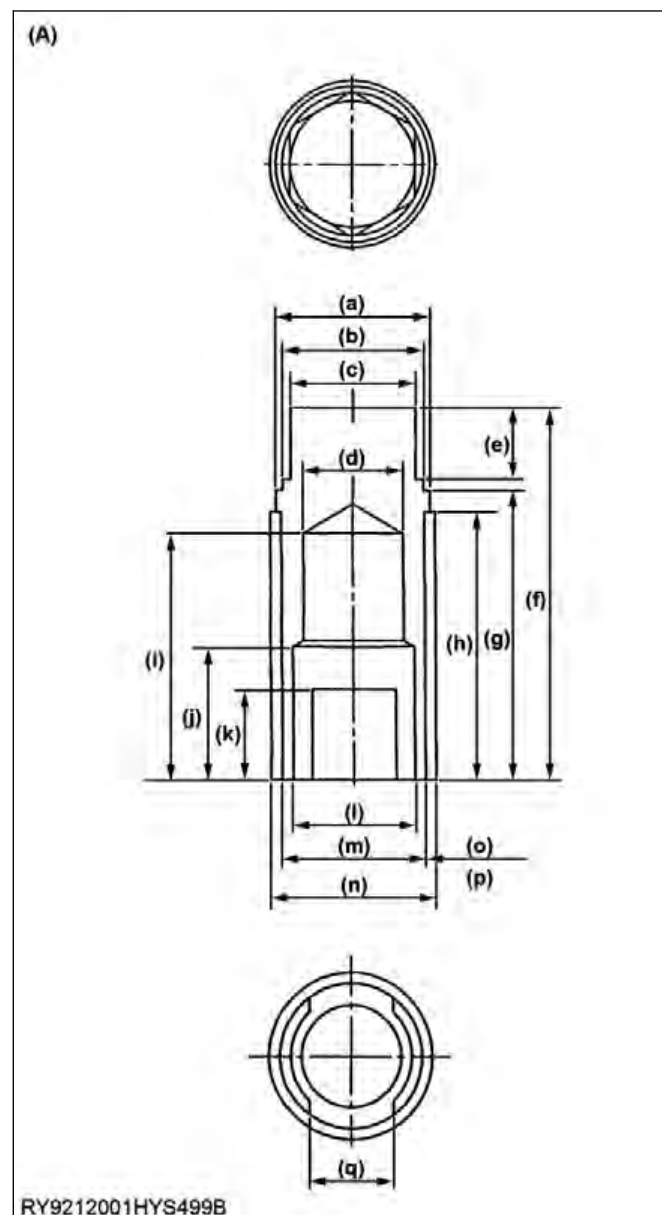
Pipe fittings (M12-G1/4)



	Dimension
(a)	47 mm 1.85 in.
(b)	12 mm 0.47 in.
(c)	15 mm 0.59 in.
(d)	20 mm 0.79 in.
(e)	10 mm 0.39 in.
(f)	12 mm 0.47 in.
(g)	φ8 mm φ0.31 in.
(h)	φ3 mm φ0.12 in.
(i)	φ8 mm φ0.71 in.
(j)	φ9±0.2 mm φ0.37±0.01 in.
(k)	19 mm 0.75 in.
(l)	21.9 mm 0.86 in.
(m)	M12 × 1.5
(n)	G1/4
(o)	30°

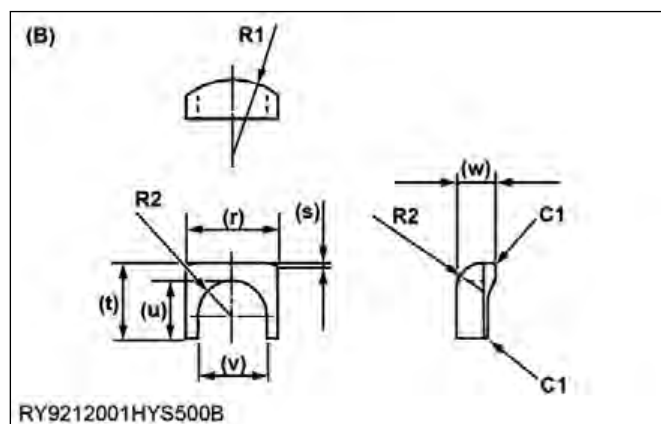
4. Universal joint tightening jig

Universal joint tightening jig 1

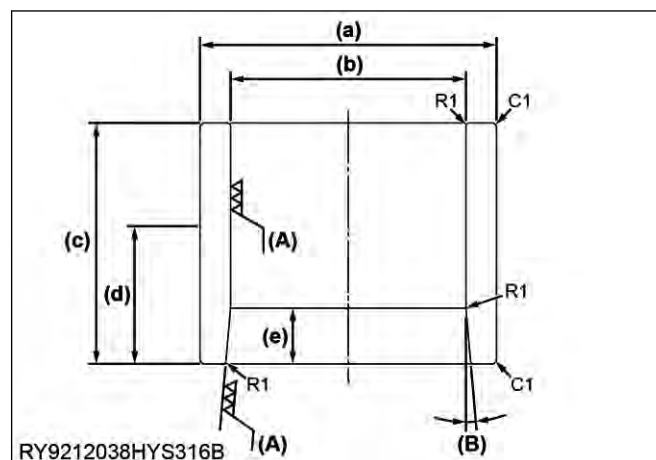


(A) Universal joint tightening jig
1 detail view

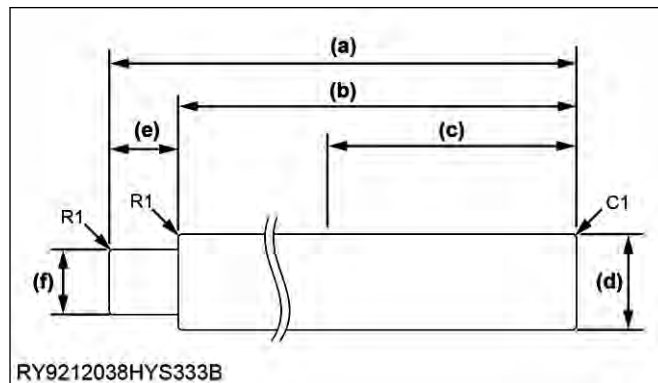
	Dimension
(a)	φ29 mm φ1.14 in.
(b)	φ26.5 mm φ1.04 in.
(c)	23.5 mm 0.93 in.
(d)	φ19 mm φ0.75 in.
(e)	Less than 13 mm Less than 0.51 in.
(f)	Less than 69 mm Less than 2.72 in.
(g)	54 mm 2.13 in.
(h)	50 mm 1.97 in.
(i)	46 mm 1.81 in.
(j)	25 mm 0.98 in.
(k)	17 mm 0.67 in.
(l)	φ23 mm φ0.91 in.
(m)	φ27 mm φ1.06 in.
(n)	φ31 mm φ1.22 in.
(o)	H6 mm
(p)	N6 mm
(q)	φ16 mm φ0.63 in.

Universal joint tightening jig 2(B) Universal joint tightening jig
2 detail view

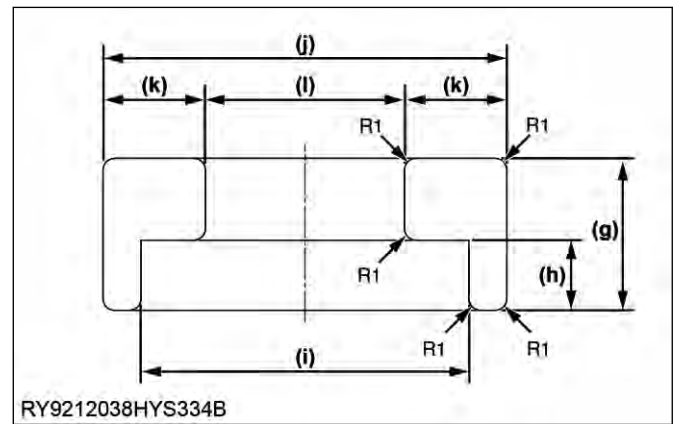
	Dimension
(r)	15.5 mm 0.61 in.
(s)	0.5 × 15 mm 0.02 × 0.59 in.
(t)	12.5 mm 0.49 in.
(u)	9.5 mm 0.37 in.
(v)	Less than 11.6 mm Less than 0.46 in.
(w)	Less than 6.5 mm Less than 0.26 in.
C1	0.5 mm chamfer 0.02 in. chamfer
R1	R13 mm R0.51 in.
R2	R5.8 mm R0.23 in.

5. HST motor special jigs**Piston ring correction jig**

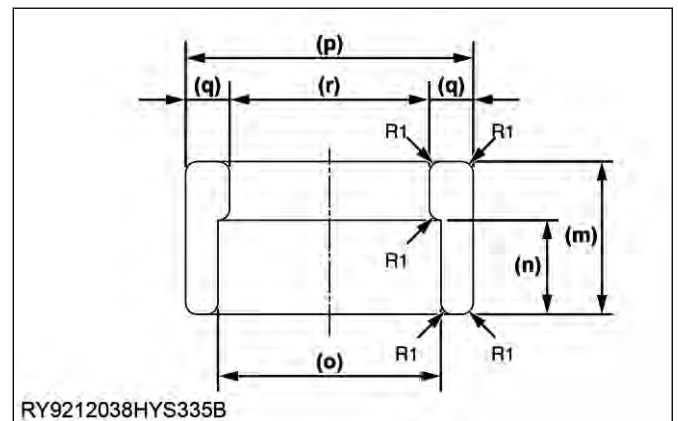
	Dimensions
(a)	$\phi 80$ mm $\phi 3.15$ in.
(b)	$\phi 63.5$ to 63.58 mm $\phi 2.500$ to 2.500315 in.
(c)	65 mm 2.56 in.
(d)	35 mm 1.38 in.
(e)	15 mm 0.59 in.
C1	1 mm 0.039 in.
R1	1 mm 0.039 in.
Material	S45C
Hardening and tempering	HRC40 to 45

Needle bearing installation jig

	Dimension
(a)	200 mm 7.87 in.
(b)	182 mm 7.17 in.
(c)	60.5 mm 2.38 in.
(d)	$\phi 25$ mm $\phi 0.98$ in.
(e)	18 mm 0.71 in.
(f)	$\phi 17$ mm $\phi 0.67$ in.
C1	1 mm 0.039 in.
R1	1 mm 0.039 in.



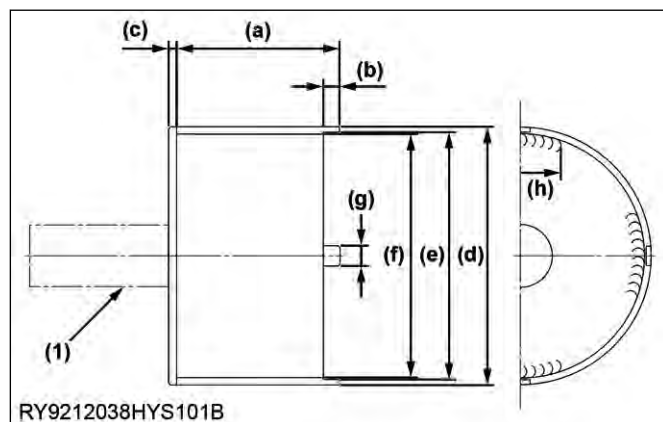
	Dimension
(g)	13 mm 0.51 in.
(h)	6 mm 0.24 in.
(i)	$\phi 28$ mm $\phi 1.10$ in.
(j)	$\phi 34.5$ mm $\phi 1.36$ in.
(k)	9 mm 0.35 in.
(l)	$\phi 17$ mm $\phi 0.67$ in.
R1	1 mm 0.039 in.



	Dimension
(m)	13 mm 0.51 in.
(n)	8 mm 0.32 in.
(o)	φ19 mm φ0.75 in.
(p)	φ24.5 mm φ0.97 in.
(q)	3.7 mm 0.15 in.
(r)	φ17 mm φ0.67 in.
R1	1 mm 0.039 in.

6. HST motor special jigs

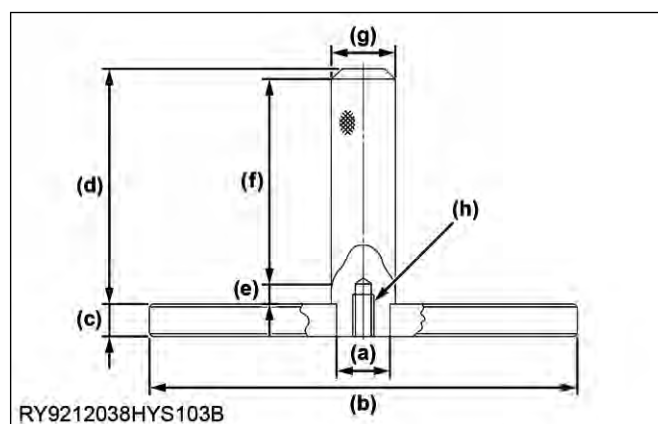
(A) Ring nut wrench



(1) Box (P6SL29)

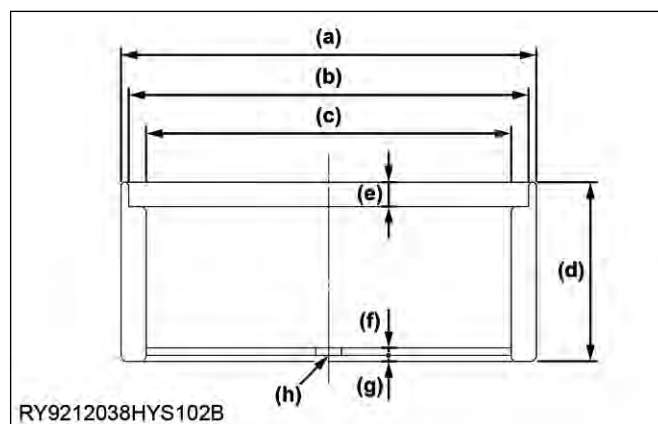
	Dimension
(a)	100 mm 3.94 in.
(b)	10.1 mm 0.40 in.
(c)	4.50 mm 0.18 in.
(d)	φ156.9 mm φ6.18 in.
(e)	φ151 mm φ5.94 in.
(f)	φ148.9 mm φ5.87 in.
(g)	12.0 mm 0.47 in.
(h)	50.0 mm 2.00 in.
Material	SS400

(B) Angular bearing installation jig (top)

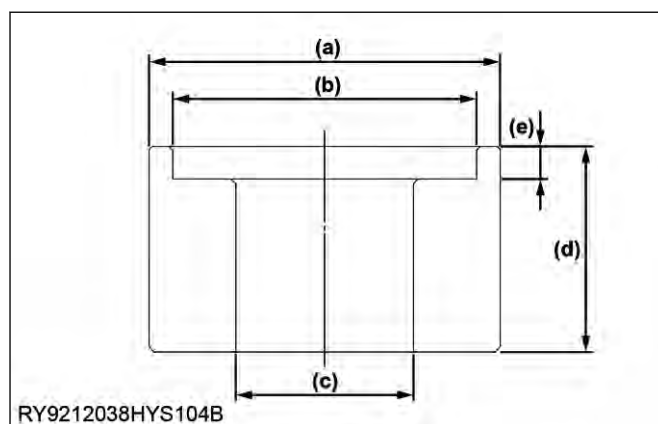


	Dimension
(a)	φ25.0 mm φ0.98 in.
(b)	φ200 mm φ7.87 in.
(c)	15.0 mm 0.59 in.
(d)	110 mm 4.33 in.
(e)	10 mm 0.39 in.
(f)	95 mm 3.74 in.
(g)	φ30.0 mm φ1.18 in.
(h)	M10 × P1.25
Material	S45C-D SS400

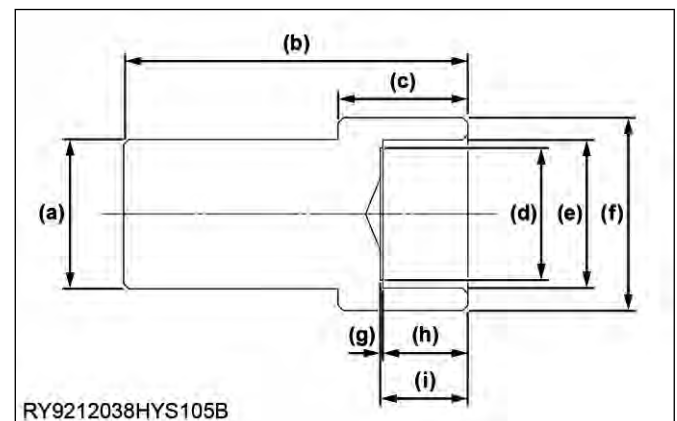
(C) Angular bearing installation jig (bottom)



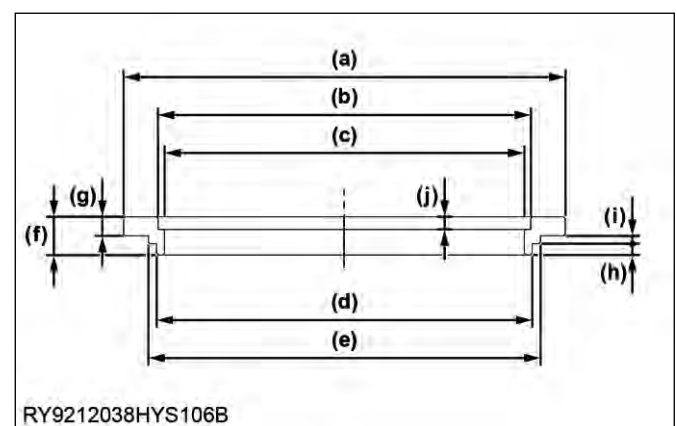
	Dimension
(a)	$\phi 174$ mm $\phi 6.85$ in.
(b)	$\phi 168$ mm $\phi 6.61$ in.
(c)	$\phi 154$ mm $\phi 6.06$ in.
(d)	75.0 mm 2.95 in.
(e)	10.0 mm 0.39 in.
(f)	3.20 mm 0.13 in.
(g)	2.0 mm 0.08 in.
(h)	$\phi 10.5$ mm $\phi 0.41$ in.
Material	SS400

(D) Roller bearing removal and installation jig

	Dimension
(a)	$\phi 60.0$ mm $\phi 2.36$ in.
(b)	$\phi 52.05$ mm $\phi 2.049$ in.
(c)	$\phi 30.0$ mm $\phi 1.20$ in.
(d)	35.0 mm 1.40 in.
(e)	5.0 mm 0.20 in.
Material	SS400

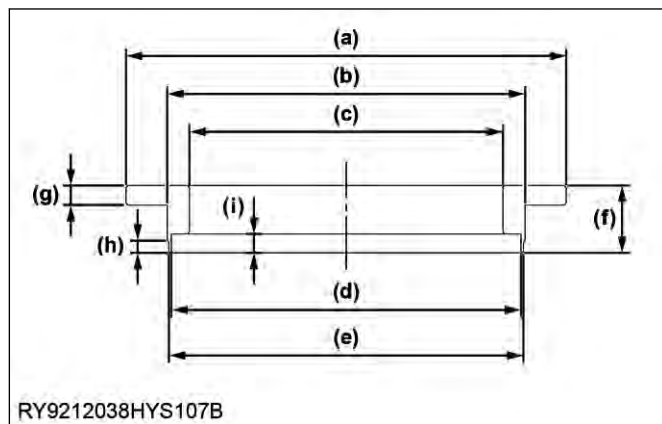
(E) Oil seal installation jig

	Dimension
(a)	$\phi 35.0$ mm $\phi 1.40$ in.
(b)	80.0 mm 3.10 in.
(c)	30 mm 1.20 in.
(d)	$\phi 31.0$ mm $\phi 1.22$ in.
(e)	$\phi 35.2$ mm $\phi 1.39$ in.
(f)	$\phi 45.0$ mm $\phi 1.77$ in.
(g)	0.50 mm 0.02 in.
(h)	19.5 mm 0.77 in.
(i)	20.0 mm 0.79 in.
Material	SS400

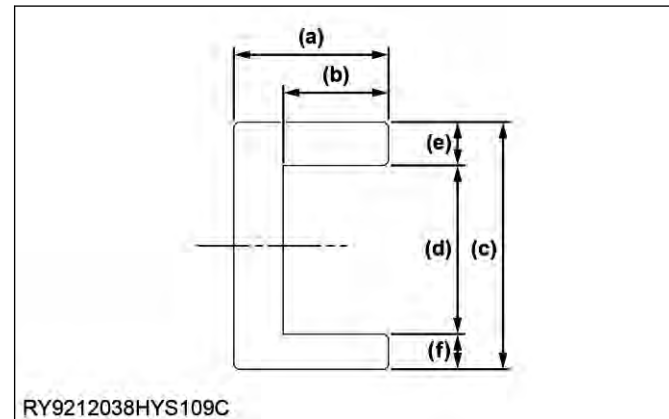
(F) Floating seal installation jig (guide)

2. GENERAL

	Dimension
(a)	φ232 mm φ9.13 in.
(b)	φ195.8 mm φ7.71 in.
(c)	φ189 mm φ7.44 in.
(d)	φ197.3 mm φ7.77 in.
(e)	φ206 mm φ8.11 in.
(f)	20.0 mm 0.79 in.
(g)	10.0 mm 0.39 in.
(h)	6.0 mm 0.24 in.
(i)	4.0 mm 0.16 in.
(j)	6.5 mm 0.26 in.
Material	SS400

(G) Floating seal installation jig (pusher)

	Dimension
(a)	φ232 mm φ9.13 in.
(b)	φ188.5 mm φ7.42 in.
(c)	φ165 mm φ6.50 in.
(d)	φ183.9 mm φ7.25 in.
(e)	φ186.9 mm φ7.36 in.
(f)	35.0 mm 1.40 in.
(g)	10.0 mm 0.39 in.
(h)	6.0 mm 0.24 in.
(i)	10.0 mm 0.39 in.
Material	SS400

(H) Inner race puller

	Dimension
(a)	44.0 mm 1.73 in.
(b)	30.0 mm 1.18 in.
(c)	70.0 mm 2.76 in.
(d)	48.0 mm 1.89 in.
(e)	12.0 mm 0.47 in.
(f)	10.0 mm 0.39 in.
Material	SS400

3. MAINTENANCE

MAINTENANCE INTERVALS TABLE

No.	Check points		Measures	Hour meter indication								Intervals	Re- marks	Reference
				5 0	2 5 0	5 0 0	1 0 0	1 5 0	2 0 0	3 0 0				
1	Coolant level *1		Check	Daily check										3-9
2	Fuel level *1		Check	Daily check										3-9
3	Engine oil level *1		Check	Daily check										3-9
4	Hydraulic oil level *1*2		Check	Daily check										3-10
5	Lubrication point		Grease	Daily check										3-11
6	Radiator and oil cooler *1		Check	Daily check										3-11
7	Engine and engine electrical wire harnesses *1		Check	Daily check										3-12
8	Fan belt *1		Check	Daily check										3-12
9	Water separator		Drain	Daily check										3-12
10	Dust valve		Check	Daily check										3-13
11	DPF muffler		Check	Daily check										3-41
12	Washer liquid level *1		Check	Daily check										3-13
13	Battery *1		Check	Daily check										3-14
14	Fuel tank		Drain	○	○	○	○	○	○	○	○	Every 50 h		3-17
15	Track tension		Check	○	○	○	○	○	○	○	○	Every 50 h		3-17
16	Air cleaner elements *3	Outer element	Check	○	○	○	○	○	○	○	○	Every 50 h	@	3-17
17	Dust valve		Clean	○	○	○	○	○	○	○	○	Every 50 h		3-18
18	Air cleaner elements *3	Outer element	Replace		○	○	○	○	○	○	○	Every 250 h	@	3-19
		Inner element	Replace		○	○	○	○	○	○	○	Every 250 h	@	
19	Radiator hoses and clamps *1		Check		○	○	○	○	○	○	○	Every 250 h		3-19
20	Fuel line *1*5		Check		○	○	○	○	○	○	○	Every 250 h		3-20
21	Intake air line *1		Check		○	○	○	○	○	○	○	Every 250 h		3-20
22	Main frame		Clean		○	○	○	○	○	○	○	Every 250 h		3-21
23	Fan belt *1		Adjust		○	○	○	○	○	○	○	Every 250 h		3-21
24	Engine oil		Replace			○	○	○	○	○	○	Every 500 h		3-23
25	Engine oil filter		Replace			○	○	○	○	○	○	Every 500 h		3-24
26	Water separator element *5		Replace			○	○	○	○	○	○	Every 500 h		3-26
27	Fuel filter *5		Replace			○	○	○	○	○	○	Every 500 h	@	3-25
28	HST motor gear oil		Replace		●	○	○	○	○	○	○	Every 500 h		3-25
29	Return filter		Replace		●	○	○	○	○	○	○	Every 500 h		3-27
30	Breather filter		Replace			○	○	○	○	○	○	Every 500 h		3-28

(Continued)

3. MAINTENANCE

No.	Check points	Measures	Hour meter indication							Intervals	Re- marks	Reference
			5 0	2 5 0	5 0 0	1 0 0 0	1 5 0 0	2 0 0 0	3 0 0 0			
31	HST filter	Replace	●		○	○	○	○	○	Every 500 h		3-28
32	Fan belt	Replace			○	○	○	○	○	Every 500 h		3-28
33	Suction filter	Replace				○		○	○	Every 1000 h		3-31
34	Hydraulic oil	Replace				○		○	○	Every 1000 h		3-32
35	Injector	Check					○		○	Every 1500 h	@	3-33
36	Oil separator element	Replace					○		○	Every 1500 h	@	3-33
37	EGR cooler	Check					○		○	Every 1500 h	@	3-34
38	Starter motor	Check						○		Every 2000 h		3-37
39	Alternator	Check						○		Every 2000 h		3-37
40	EGR system	Check							○	Every 3000 h	@	3-39
41	Turbocharger *1	Check							○	Every 3000 h	@	3-39
42	DPF muffler *4	Clean							○	Every 3000 h	@	3-40
43	Exhaust gas line *1	Check								Every 1 year		3-41
44	Intake air line *1	Check								Every 1 year		3-41
45	DPF muffler *4	Check								Every 1 year		3-41
46	EGR and EGR piping *1	Check								Every 1 year		3-43
47	CCV heater *1	Check								Every 1 year		3-43
48	Radiator hoses and clamps *1	Replace								Every 2 years		3-46
49	Fuel line *1*5	Replace								Every 2 years		3-47
50	Intake air line *1	Replace								Every 2 years		3-48
51	Coolant	Replace								Every 2 years		3-45
52	Oil separator rubber piping	Replace								Every 2 years		3-46
53	DPF differential pressure sensor *4 and rubber piping *1	Replace								Every 2 years		3-47
54	EGR cooler hose	Replace								Every 2 years		3-48

Air conditioning

No.	Check points		Measures	Hour meter indication								Intervals	Re- marks	Reference
				5 0	2 5 0	5 0 0	1 0 0	1 5 0	2 0 0	3 0 0				
1	Air conditioning belt *1		Check	Daily check										3-51
2	Air filter *3	Recirculation air filter	Clean		○	○	○	○	○	○	○	Every 250 h		3-51
		Fresh air filter	Clean		○	○	○	○	○	○	○	Every 250 h		
3	Condenser		Clean		○	○	○	○	○	○	○	Every 250 h		3-52
4	Air conditioning belt *1		Adjust		○	○	○	○	○	○	○	Every 250 h		3-52
			Replace			○	○	○	○	○	○	Every 500 h		3-53
5	Air filter *3	Recirculation air filter	Replace				○		○	○	○	Every 1000 h		3-53
		Fresh air filter	Replace				○		○	○	○	Every 1000 h		
6	Air conditioning and heater hoses		Check									Every 1 years		3-54
7	Air conditioning and heater hoses		Replace									Every 2 years		3-55
8	Refrigerant		Check									Perform maintenance as required		3-55

* The maintenance identified with ● must be carried out once the specified hours of operation after initial commissioning have been reached.

*1 Replace only if necessary.

*2 When using a hydraulic breaker, change hydraulic oil and return filter according to the table on the operator's manual.

*3 Clean and replace the air filter and the air cleaner element more frequently if used under dusty conditions. When the filter is very dirty due to dusty conditions, replace it.

*4 Carry out this maintenance referring to "DPF HANDLING MANUAL (FOR COMPACT TRACK LOADER)".

*5 Maintenance interval is half when using biodiesel fuel B6 to B20. (Maintenance interval is same as diesel fuel when using biodiesel fuel B0 to B5).

■ IMPORTANT

- The items listed above (marked with @) are registered as emission-related critical parts by Kubota in the U.S.EPA non-road emission regulation. As the engine owner, you are responsible for the performance of the required maintenance on the engine according to the above instruction. Please refer to the warranty statement for detail.

LUBRICANT QUANTITY

		Quantity	Remarks
Engine oil	Engine	8.5 L 2.2 U.S.gals	Including engine oil filter
	Front idler	180 to 200 cc 11.0 to 12.2 in. ³	
	Rear idler	165 to 185 cc 10.1 to 11.2 in. ³	
	Track roller	170 cc 10.4 in. ³	
Coolant	Without reserve tank	8.5 L 2.2 U.S.gals	
	Reserve tank	1.0 L 0.3 U.S.gals	At [FULL] mark
Hydraulic oil	All hydraulic system	48 L 12.7 U.S.gals	—
	Hydraulic oil tank	20 L 5.3 U.S.gals	At center of gauge
Fuel	Fuel tank	82 L 21.7 U.S.gals	—
Gear oil	HST motor	1.0 L 0.26 U.S.gals	—

RECOMMENDED LUBRICANT

	Recommendation			Filled at factory	
	Ambient temperature conditions	Viscosity	Quality standard	Brand	Type
Engine oil	Above 25 °C (77 °F)	SAE 30 SAE 10W-30 SAE 15W-40	API CJ-4	—	API CJ-4
	0 to 25 °C (32 to 77 °F)	SAE 20 SAE 10W-30 SAE 15W-40			
	Under 0 °C (32 °F)	SAE 10W SAE 10W-30 SAE 15W-40			
Grease	—	—	—	COSMO	Dynamax EP2
Hydraulic oil	Kubota Hydraulic Fluid 46HD			IDEMITU	DAPHNE SUPER HYDRO 46ST
Gear oil	—	SAE 90	API GL-4, GL-5	JXTG	Gear oil GL-5
Fuel	Above -5 °C (23 °F)	—	ASTM D975 No.2-D S15	—	—
	Under -5 °C (23 °F)	—	ASTM D975 No.1-D S15	—	—

Engine oil and fuel grade

Engine oil	API CJ-4
Fuel	Ultra low sulfur fuel < 0.0015% (15 ppm)

NOTE

- **Engine oil**
 - Oil used in the engine should have an American Petroleum Institute (API) service classification and should be a proper SAE engine oil according to the ambient temperatures.
 - Use the ultra low sulfur diesel fuel only for these engines.
- **Grease**
 - Perform the initial replacement 50 hours after starting using this machine.
- **Fuel**
 - Cetane number of 45 is minimum. Cetane number greater than 50 is preferred, especially for temperature below -20 °C (-4 °F) or elevations above 1500 m (5000 ft).
 - Diesel fuels conforming with ASTM D975 is recommended.
 - No.2-D is a distillate fuel with lower volatility for engines in industrial and heavy mobile service (SAE J313 JUN87).

DAILY CHECK

1. Checking the coolant level

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



CAUTION

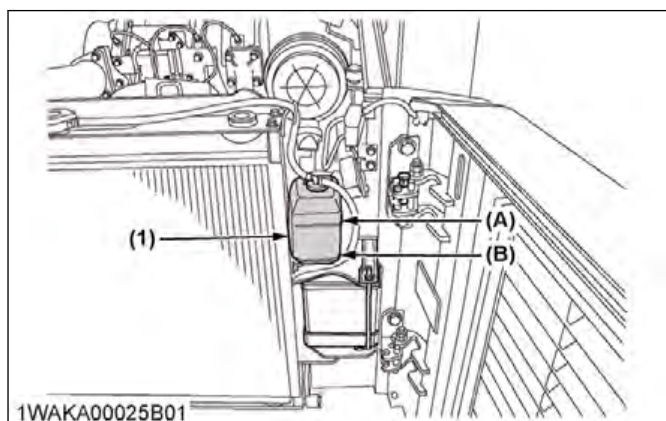
- Check that the rear bonnet is securely locked.

Checking

1. Check that the coolant level is between **[FULL]** and **[LOW]**.

NOTE

- Check the coolant level in the reserve tank after the engine has cooled down.



- (1) Reserve tank
(A) **[FULL]**
(B) **[LOW]**

2. Replenish the coolant into the reserve tank if necessary.

IMPORTANT

- Do not replenish the coolant exceeding **[FULL]**.
- Do not mix the coolant with dirty or salt water.
- In the case that the coolant level decreases soon after replenishing, there is a possibility of cooling system leakage. Repair the cooling system before starting the engine.

2. Checking the fuel level



WARNING

- Keep fire and flammable items away from the working area.

IMPORTANT

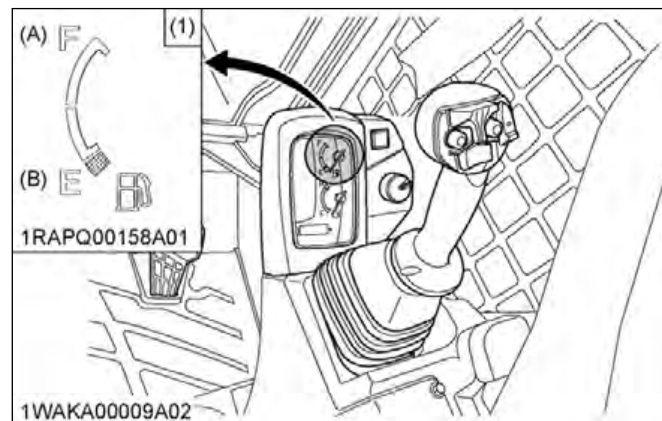
- If the fuel is empty, do not start the engine to avoid mixing of the air into the fuel system.
- Fully replenish the fuel into the fuel tank before parking overnight to prevent condensation in the fuel tank.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Checking

1. Turn the starter switch to **[RUN]**.
2. Check the fuel level on the meter panel.



- (1) Fuel gauge
(A) Full
(B) Empty

3. Replenish the fuel if necessary.

Recommended oil

Diesel fuel	Above -5 °C (23 °F)	ASTM D975 No.2-D S15
	Below -5 °C (23 °F)	ASTM D975 No.1-D S15

3. Checking the engine oil level

IMPORTANT

- If the oil level is too high or too low, the engine may be damaged during operation.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

**CAUTION**

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.

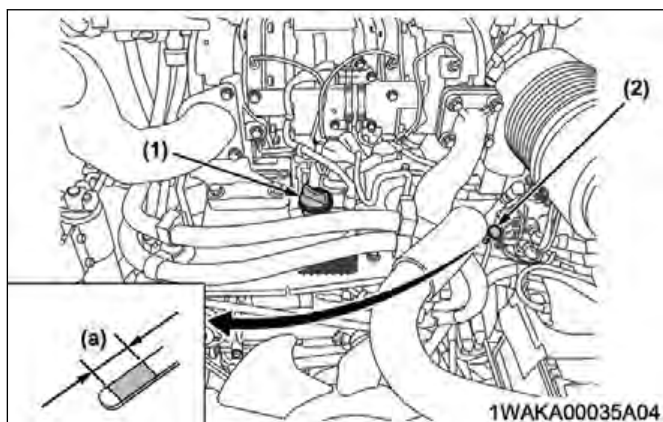
Checking

1. Pull the engine oil gauge out of the engine and wipe the engine oil off.

NOTE

- Check the engine oil level 5 minutes after stopping the engine.

2. Fully insert the engine oil gauge into the dipstick port.
3. Pull the engine oil dipstick out of the engine again and check the engine oil level.



- (1) Oil filler port
(2) Dipstick

- (a) Correct oil level range

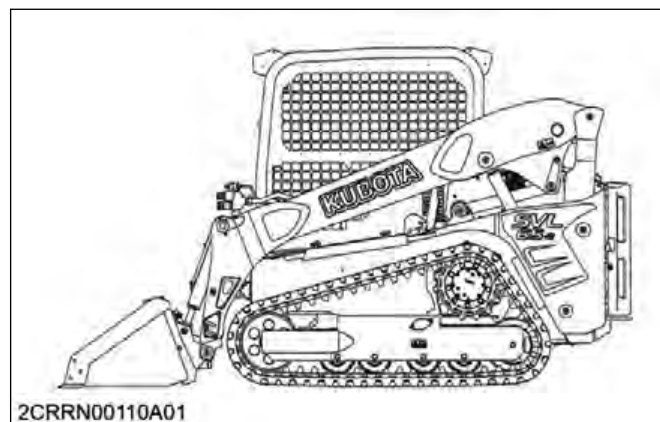
4. Replenish the engine oil if necessary.

Recommended oil

Engine oil	Above 25 °C (77 °F)	API CJ-4 SAE 30 SAE 10W-30 SAE 15W-40
	0 to 25 °C (32 to 77 °F)	API CJ-4 SAE 20 SAE 10W-30 SAE 15W-40
	Under 0 °C (32 °F)	API CJ-4 SAE 10W SAE 10W-30 SAE 15W-40

4. Checking the hydraulic oil level

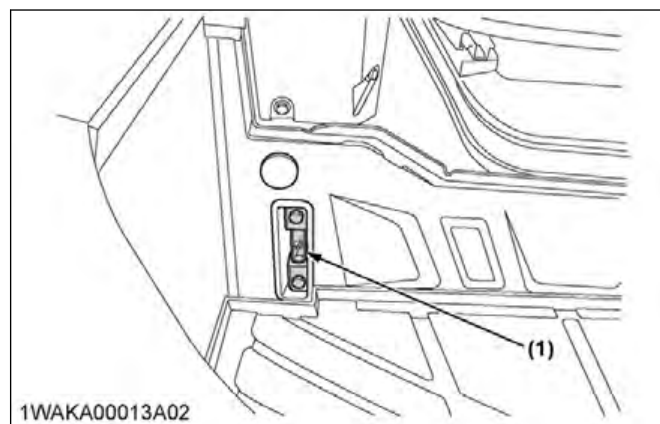
1. Operate the machine to the hydraulic oil checking position (lower the front attachment or quick hitch to the ground, and stop the engine).



2. Check the hydraulic oil level with the level gauge while the temperature of the hydraulic oil is between 10 to 30 °C (50 to 86 °F).

NOTE

- Make sure that the oil level is in between half and three-quarters on the level gauge.

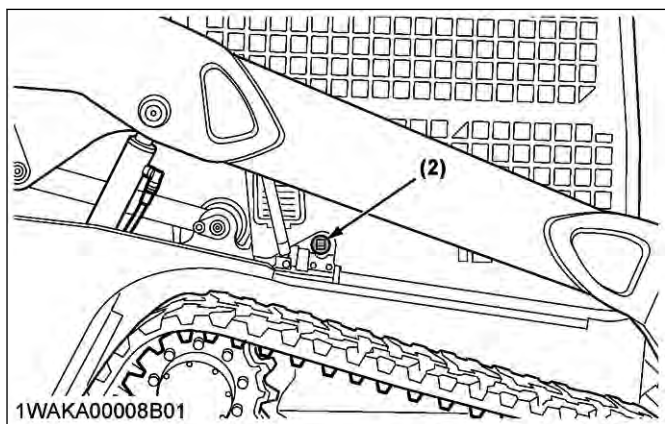


- (1) Hydraulic oil gauge

3. Replenish the hydraulic oil if necessary.

IMPORTANT

- Clean the surface of the hydraulic oil tank around the oil filler port before replenishing the hydraulic oil to avoid dust contamination.
- Do not use or mix different oil.



(2) Hydraulic oil tank cap

5. Greasing the lubrication point

■ IMPORTANT

- Grease the machine before working.
- In the case of working the machine in water, grease again after finish working.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

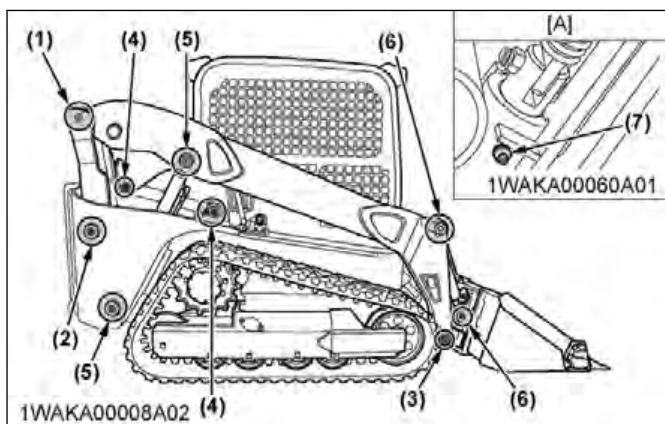
Greasing

1. Grease each grease fitting.

■ NOTE

- Clean around the grease fittings before and after greasing.

Lubrication points



- | | |
|----------------------------|--------------------------|
| (1) Lift arm linkage | (6) Bucket cylinder boss |
| (2) Link 1 | (7) Quick hitch pin |
| (3) Bucket link pin | [A] Quick hitch model |
| (4) Control link | |
| (5) Lift arm cylinder boss | |

Number of lubrication point

(1) Lift arm linkage	2
(2) Link 1	2
(3) Bucket link pin	2
(4) Control link	4
(5) Lift arm cylinder boss	4
(6) Bucket cylinder boss	4
(7) Quick hitch pin	2
Total	20

6. Checking the radiator and oil cooler



CAUTION

- Wear eye protector when cleaning the radiator and oil cooler with compressed air.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

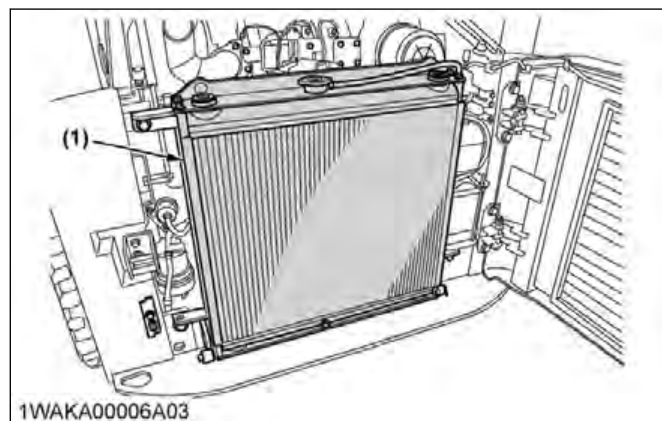


CAUTION

- Check that the rear bonnet is securely locked.

Checking

1. Check if the fins and ribs of the radiator and oil cooler are clogged.



- (1) Radiator and oil cooler
2. Remove the dirt with compressed air if necessary.

■ IMPORTANT

- Pressure of compressed air must be under 205 kPa (2.1 kgf/cm², 30 psi).
3. Check the radiator and oil cooler for damage and replace them if necessary.

3. MAINTENANCE

7. Checking the engine and electrical wiring

4. Check the rubber hoses and replace them if necessary.
5. Check the bolts that fix the hose clamps for any looseness and tighten them if necessary.

7. Checking the engine and electrical wiring

1. Check the function of the room light.
2. Check the function of the worklight.
3. Check the function of the blower motor.
4. Check the tightness and condition of all accessible electrical wiring and connectors.
5. Repair or replace the damaged parts.
6. Check for the rust and dirt of the fuses and clean if necessary.

8. Checking the fan belt

CAUTION

- Stop the engine, remove the key, and hang a **DO NOT OPERATE** tag near the operator's seat when checking or adjusting the fan belt and air conditioning belt.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

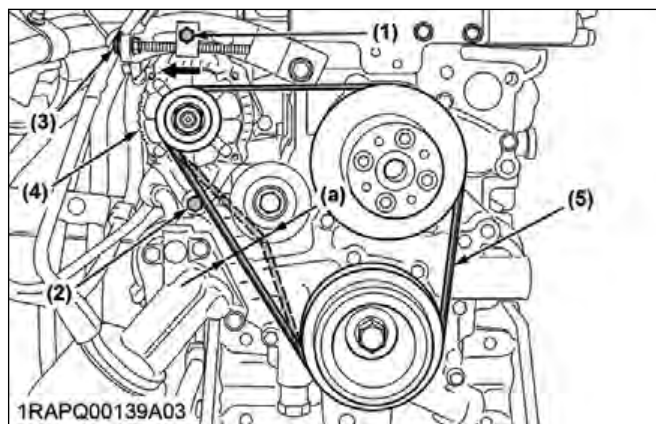
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.

Checking

1. Check the fan belt for crack and damage and replace it if necessary.
2. Push position (a) to check the fan belt tension.



- (1) Bolt
(2) Bolt
(3) Adjuster bolt
(4) Alternator
(5) Fan belt

3. Adjust the fan belt tension if necessary.

Service specification

(a) Fan belt tension	4.0 to 5.0 mm 0.16 to 0.20 in.	Push with 50 to 60 N Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf
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9. Draining the water separator

WARNING

- Keep fire and flammable items away from the working area.

■ IMPORTANT

- Keep dust away from the working area.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

CAUTION

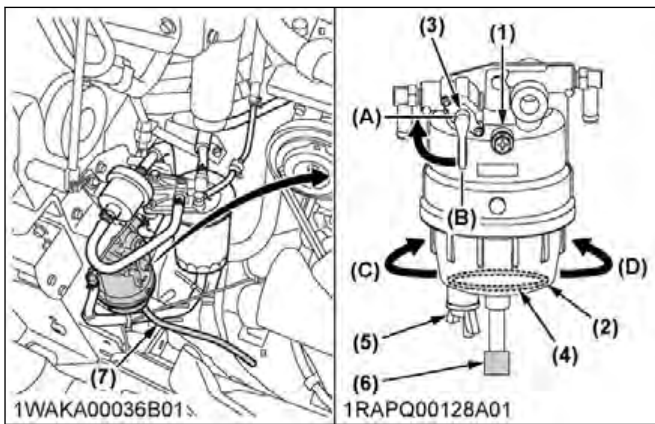
- Check that the rear bonnet is securely locked.

Draining

1. Disconnect the water level sensor connector.
2. Turn the water separator lever to close the water separator.
3. Put a tray under the drain hose to receive the fuel.
4. Loosen the drain plug and drain the water.

■ NOTE

- Clean the cup with fuel if necessary.



- | | |
|----------------------------------|-------------|
| (1) Screw | (7) Hose |
| (2) Cup | (A) Close |
| (3) Water separator lever | (B) Open |
| (4) Float | (C) Loosen |
| (5) Drain plug | (D) Tighten |
| (6) Water level sensor connector | |

- Open the water separator lever.
- Bleed the air from the fuel line.

NOTE

- Bleed the air for about 10 seconds after turning the starter switch to [RUN].

10. Checking the dust valve

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.



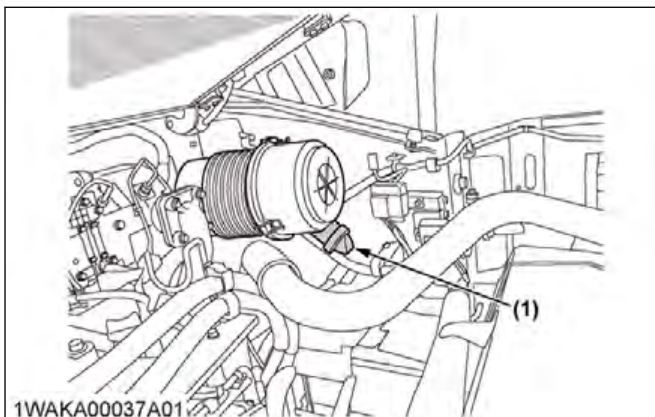
CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.

Checking

- Open the dust valve to remove dust and dirt inside of the dust valve.



- (1) Dust valve

- The dust valve can be removed to clean inside if necessary.

11. Checking the DPF muffler



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, muffler, and oil are extremely hot.
 - Pressure in the engine oil line is high.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.



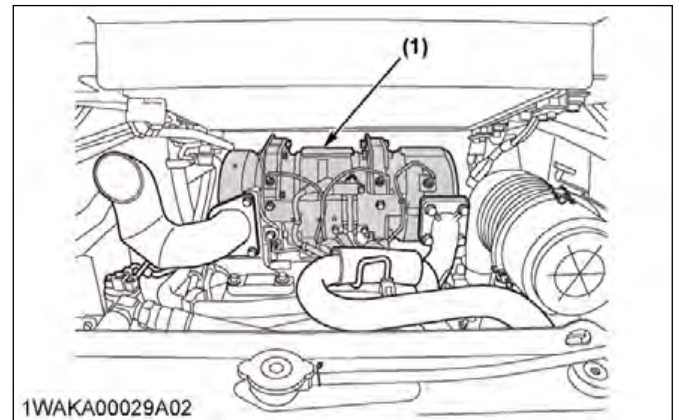
CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.

Checking

- Check if nothing flammable is deposited around the DPF muffler.



- (1) DPF muffler

NOTE

- When replacing the DPF, sign up the code to K-iss.

12. Checking the washer liquid level

Preparing

- Lower the front attachment to the ground, and stop the engine.

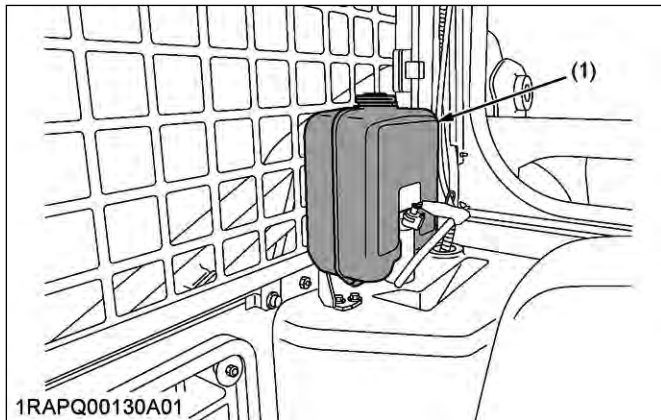
Checking

- Check the washer liquid level.

■ IMPORTANT

- Do not turn on the washer motor when the washer tank is empty to avoid damaging the washer motor.

2. Replenish the washer tank if necessary.



(1) Washer tank

Liquid quantity

Washer liquid	0.8 L 0.2 U.S.gals
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13. Checking the battery condition

! DANGER

- In the case that the electrolyte level is below the lower level line, do not use or charge the battery to avoid battery explosion.

! WARNING

- Do not remove the vent caps while the engine is running.
- Keep electrolyte away from your eyes, hands, and clothing. Sulfuric acid in battery electrolyte is poisonous and it can burn your skin and clothing and cause blindness. If you spill electrolyte on yourself, rinse yourself with water and get medical aid immediately.
- Do not use metal tools when cleaning battery terminals. It may cause short circuit.
- Do not open a maintenance-free battery.

! CAUTION

- Keep a fire (welding sparks, grinding sparks, cigarettes) away from the battery. The battery produces oxygen and hydrogen gases which are flammable.
- Disconnect the negative (-) terminal first when removing the battery cable.

- Connect the positive (+) terminal first when connecting the battery cable.

■ IMPORTANT

- For maintenance-free batteries, check of the level and density of electrolyte is not required. Check the battery condition with the indicator and replace the battery if necessary.

Preparing

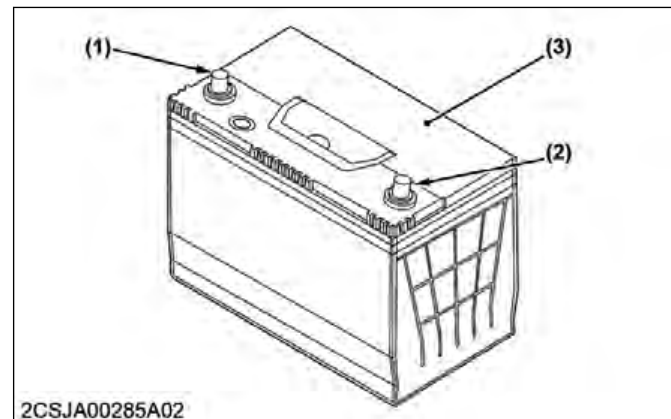
- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

**CAUTION**

- Check that the rear bonnet is securely locked.

Checking the battery terminals

- Check the condition of the battery terminals.

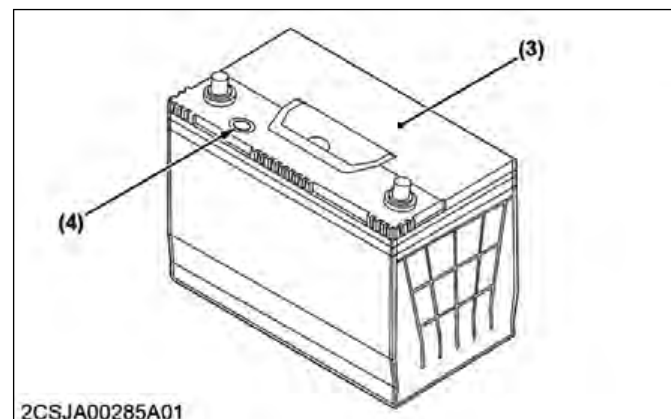


- (1) Negative (-) terminal (3) Battery
(2) Positive (+) terminal

- Clean the battery terminal, and grease with petroleum jelly if necessary.

Checking the battery indicator

- Check the battery condition with the battery indicator.



- (3) Battery (4) Indicator

Battery condition (indicator color)

Green	Black	White
Normal	Needs charging	Needs replacing

NOTE

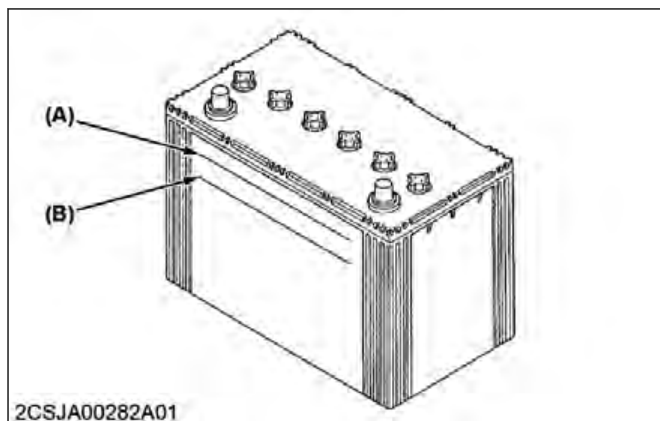
- Follow the battery manufacturer's manual for details when checking the battery indicator.

Checking the electrolyte level

- Check if the electrolyte level is in between the upper and lower level lines.
- Replenish distilled water if necessary.

IMPORTANT

- Do not add distilled water exceeding the upper level line.



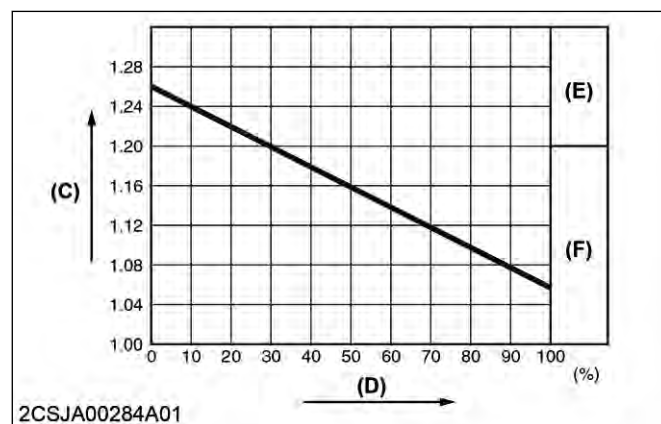
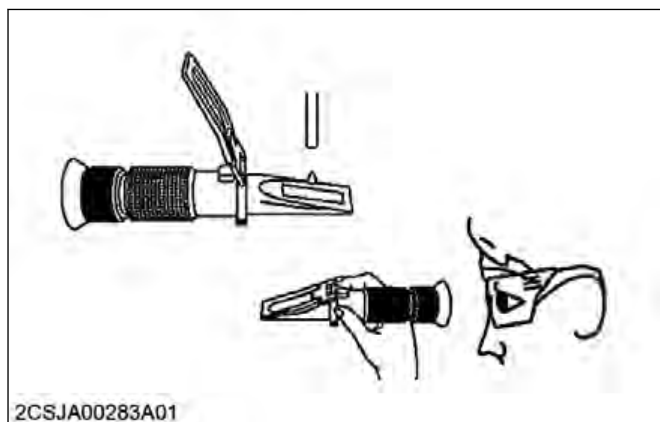
(A) Upper level line

(B) Lower level line

Checking the electrolyte density**CAUTION**

- Wear protective gloves, work clothing, and eye protector to protect your skin and eyes from sulfuric acid in battery electrolyte.

- Remove the vent caps from the battery.
- Measure the density of electrolyte with a refractometer and charge the battery if necessary.



(C) Electrolyte density

(D) Discharge

(E) Normal

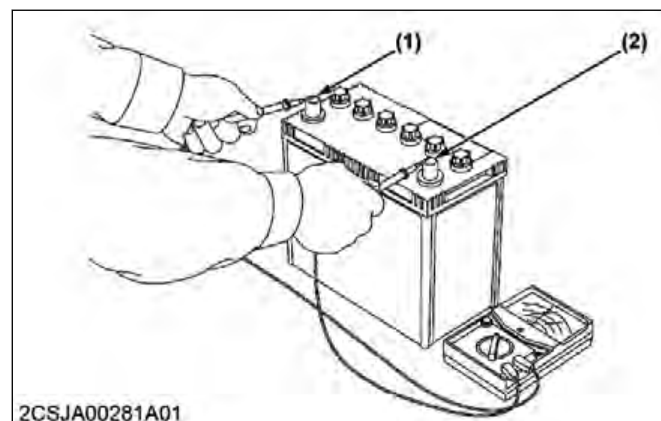
(F) Charging is required

Normal	Above 1.20
Charging is required	Less than 1.20

- Install the vent caps.

Checking the battery voltage

- Check the battery voltage with a voltage tester.



(1) Negative (-) terminal

(2) Positive (+) terminal

Battery voltage	Higher than 12 V
-----------------	------------------

- Check the electrolyte density in the case that the battery voltage is lower than the service specification.

IMPORTANT

- Replace a maintenance-free battery in the case that the battery voltage is lower than 12 V.

Charging the battery**CAUTION**

- Do not charge maintenance-free batteries.
- Wear protective gloves, work clothing, and eye protector to protect your skin and eyes from sulfuric acid in battery electrolyte.

3. MAINTENANCE

- **When working indoors, make sure to ventilate the work area.**

1. Check the electrolyte level and replenish distilled water if necessary.
2. Disconnect the battery cables from the battery.
3. Remove the vent caps.
4. Connect the battery to the charger.

■ **NOTE**

- **Follow the battery charger manufacturer's manual for details when charging the battery.**

5. Charge the battery.

■ **IMPORTANT**

- **Charge the battery in normal speed.**
- **Charge the battery in fast speed only for emergencies because fast speed charge may shorten the battery life.**

6. Check the electrolyte level after charging and replenish distilled water if necessary.
7. Install the vent caps.
8. Connect the battery cables.

EVERY 50 HOURS

1. Draining the water from the fuel tank



WARNING

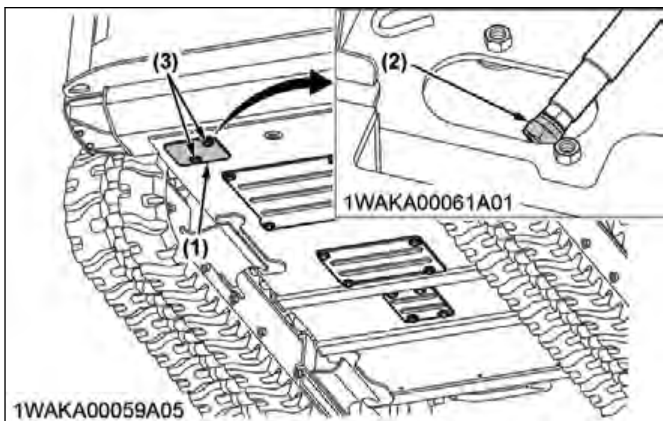
- Keep fire and flammable items away from the working area.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Draining

1. Put a tray under the drain plug to receive the water mixed fuel.
2. Remove the 2 bolts to remove the cover.
3. Remove the drain plug and drain the water-mixed fuel from the fuel tank.



- (1) Cover
(2) Drain plug
(3) Bolt (M12 × 30) × 2

2. Checking the track tension



CAUTION

- Place the machine on the jack stands securely when jacking up the machine.
- Do not work underneath when the machine is jacked up.
- Keep hands and body away from the rotating track.

IMPORTANT

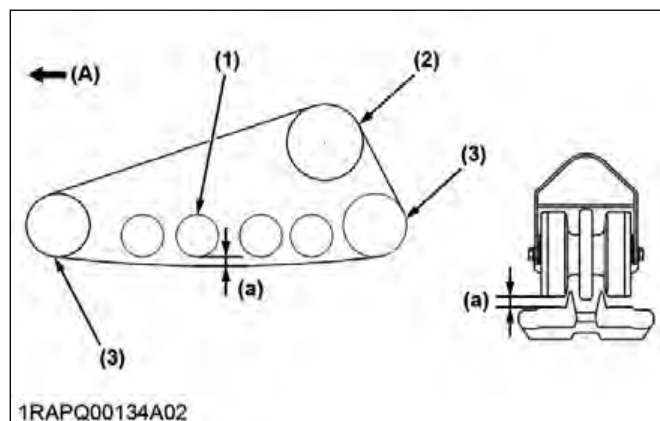
- Wear amount is increased if the tracks are too tight or loose.
- The tracks may be thrown if the tracks are too loose.

Preparing

1. Remove foreign objects such as stones caught between the tracks and sprockets, track rollers, or front idlers.
2. Jack up the machine.

Checking the rubber track tension

1. Check the track tension under the second track roller.



- (1) Second track roller
(2) Drive sprocket
(3) Idler
(a) Tension dimension
(A) Front side of the machine

Service specification

(a)	20 to 30 mm 0.8 to 1.2 in.	
-----	-------------------------------	--

3. Cleaning the outer element of the air cleaner



CAUTION

- Wear an eye protector when cleaning the outer element with compressed air.

IMPORTANT

- In the case of using the machine in extremely dusty conditions, check and clean or replace the outer element more frequently.
- In the case the air cleaner warning lamp on the meter panel lights up, check and clean or replace the outer element.
- Do not start the engine without installing the filter elements.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

- Open the rear bonnet and insert the pin into the lock position.



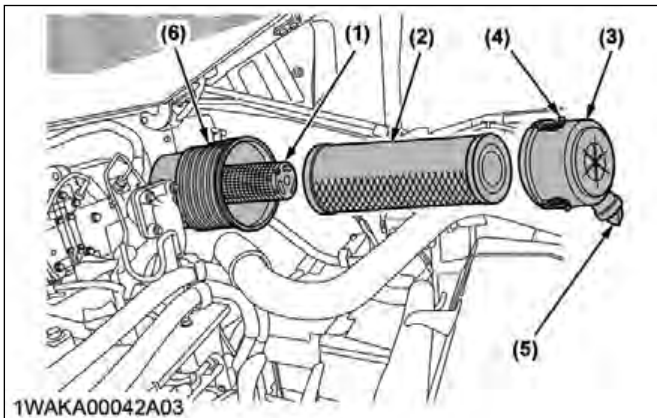
CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.

Checking and cleaning

- Open the clips and remove the cover.



- | | |
|-------------------|----------------------|
| (1) Inner element | (5) Dust valve |
| (2) Outer element | (6) Air cleaner case |
| (3) Cover | |
| (4) Clamps | |

- Remove the outer element from the air cleaner case.
- Check the outer element for damage and dirt, and replace it if necessary.
- Clean the outer element with compressed air.



IMPORTANT

- Pressure of the compressed air must be under 296 kPa (3.0 kg/cm², 43 psi).
- Blow with compressed air from the inside of the element to the outside.
- Do not use any kind of fluid to clean the outer element.

- Clean the air cleaner case and cover without removing the inner element.
- Clean the dust valve.

- Install the outer element and cover.

IMPORTANT

- Install the cover so that the top mark faces upwards.

4. Cleaning the dust valve

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.



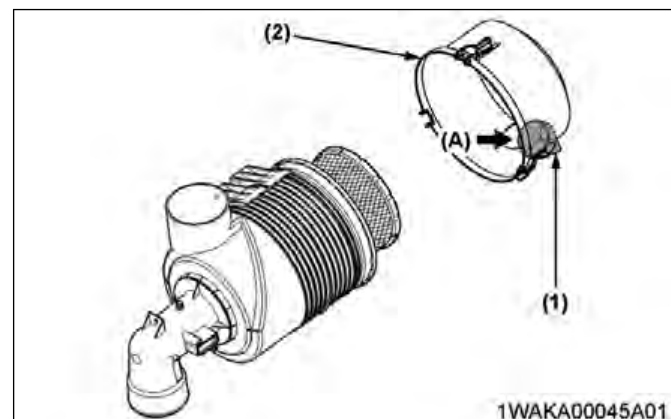
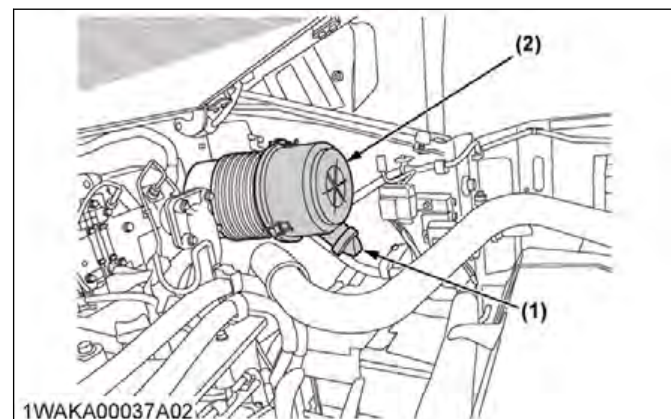
CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.

Cleaning

- Remove the dust cover.
- From behind the dust cover, remove foreign matters from the dust valve.



- | | |
|----------------|-----------------------|
| (1) Dust valve | (A) Clean from behind |
| (2) Dust cover | |

- The dust valve can be removed to clean inside if necessary.

EVERY 250 HOURS

1. Replacing the air filter elements of the air cleaner

■ IMPORTANT

- In the case of using the machine in extremely dusty conditions, replace the outer element more frequently.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



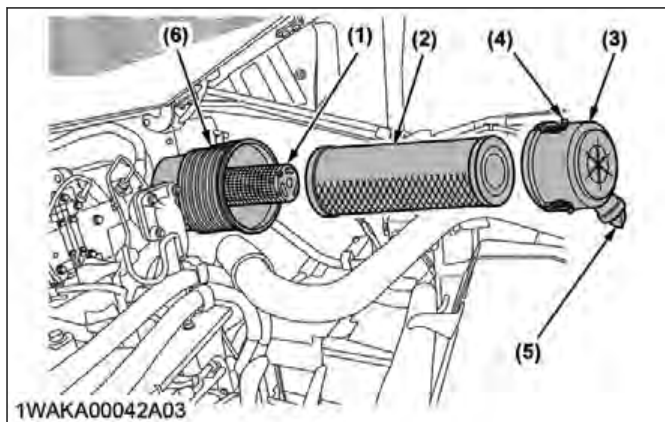
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.

Replacing

1. Open the clip and remove the cover.



- | | |
|-------------------|----------------------|
| (1) Inner element | (5) Dust valve |
| (2) Outer element | (6) Air cleaner case |
| (3) Cover | |
| (4) Clamps | |

2. Remove the outer element and inner element from the air cleaner case.
3. Clean the air cleaner case and dust valve.
4. Install a new inner and outer elements.
5. Install the cover.

■ IMPORTANT

- Install the cover so that the top mark faces upwards.

2. Checking the radiator hoses and clamps



CAUTION

- Do not work soon after the engine has stopped.
 - Coolant is extremely hot.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



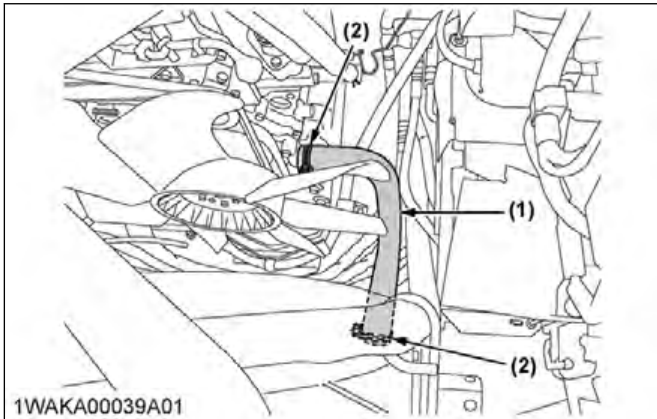
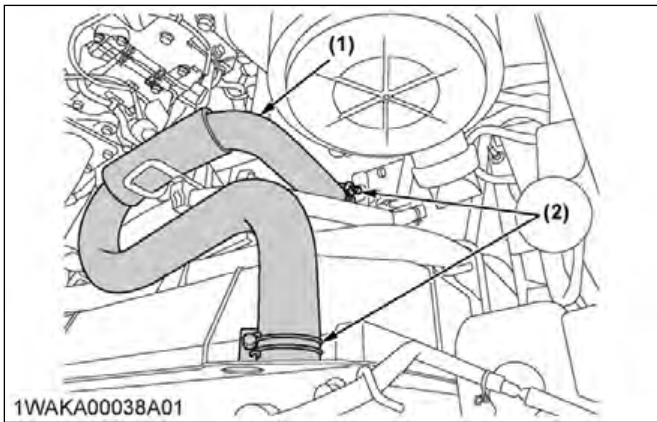
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.

Checking

1. Check the radiator hoses and replace them if necessary.
2. Check the bolts that fix the hose clamps for any looseness and tighten them if necessary.



(1) Radiator hose

(2) Hose clamp

3. Checking the fuel line

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

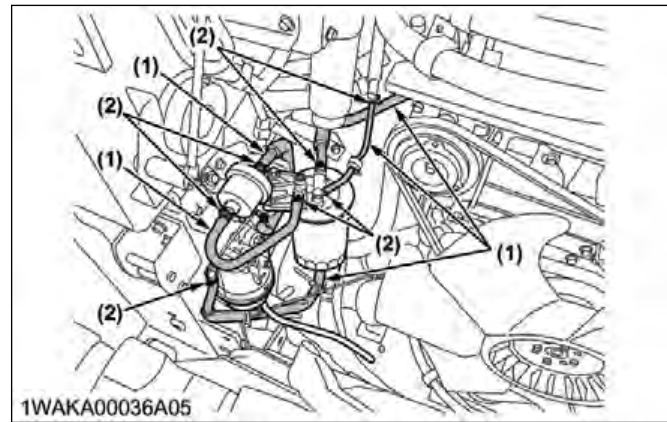
CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.
- Tilt the radiator.

Checking

- Check the fuel hoses and replace them if necessary.
- Check the tightness of the hose clamps and tighten them if necessary.



(1) Fuel hose

(2) Hose clamp

4. Checking the intake air line

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

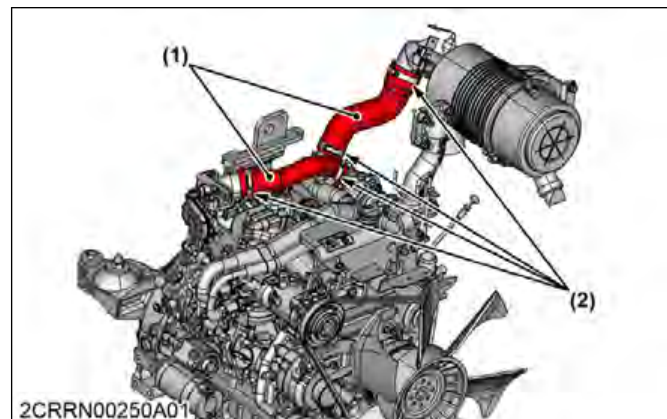
CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.

Checking

- Check the intake air hoses and replace them if necessary.
- Check the bolts that fix the hose clamps for any looseness and tighten them if necessary.



(1) Intake air hoses

(2) Hose clamps

5. Cleaning the main frame

■ IMPORTANT

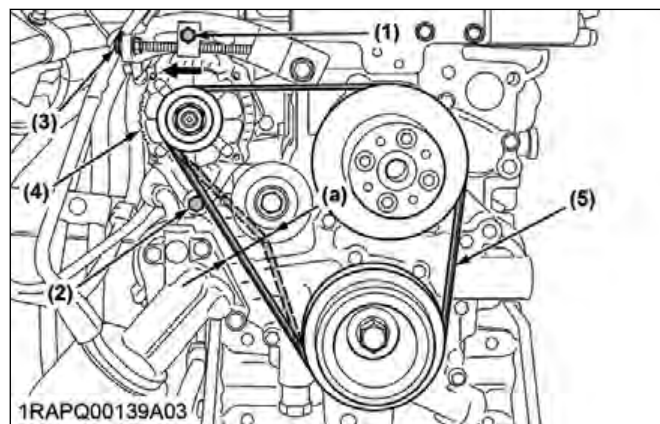
- Do not wash the machine while the engine is running.
- Do not spray water into the electrical wiring or the air cleaner.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Cleaning

1. Open the plates of the bottom of the main frame.
2. Remove mud, leaves, and any debris from the inside of the main frame.



- (1) Bolt
(2) Bolt
(3) Adjustment bolt
(4) Alternator
(5) Fan belt

6. Adjusting the fan belt



CAUTION

- Stop the engine, remove the key, and hang a **DO NOT OPERATE** tag near the operator's seat when checking or adjusting the fan belt.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.

Adjusting

1. Loosen the 2 bolts and the adjuster bolt to adjust the tension of the fan belt.
2. Move the alternator to the direction of the wide arrow, and tighten the 2 bolts and the adjustment bolt.
3. Push position (a) to check the fan belt tension.

Service specification

(a) Fan belt tension	4.0 to 5.0 mm 0.16 to 0.20 in.	Push with 50 to 60 N
		Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf

4. Start the engine and check that the fan belt does not slip.

■ IMPORTANT

- The warning lamp may be displayed if running the engine with a loose belt.

EVERY 500 HOURS

1. Replacing the engine oil



WARNING

- Keep fire and flammable items away from the working area.



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, muffler, and oil are extremely hot.
 - Pressure in the engine oil line is high.

IMPORTANT

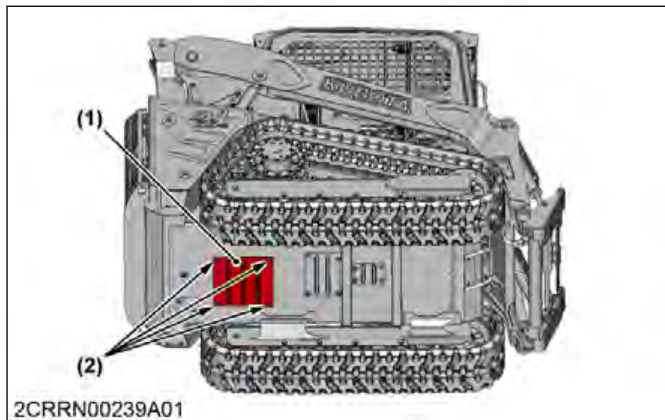
- Keep dust away from the working area.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Jack up the machine.

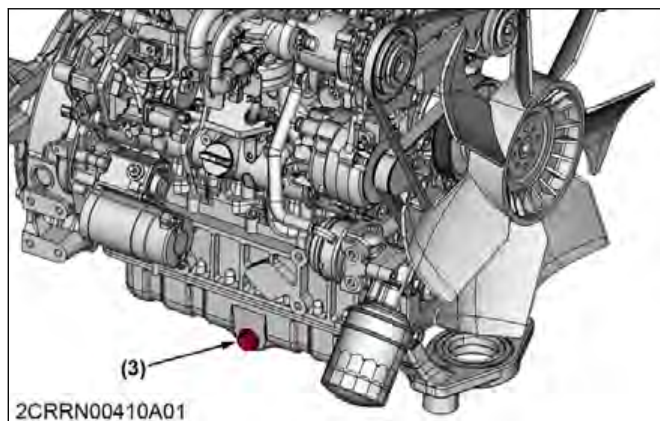
Replacing

1. Remove the 4 bolts to remove the cover.



- (1) Cover (2) Bolt (M12 × 30) × 4

2. Put a tray under the drain plug to receive the engine oil.
3. Remove the drain plug and drain all oil.

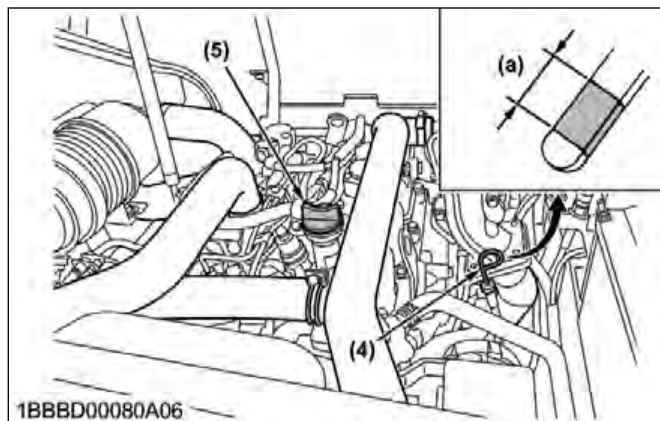


- (3) Drain plug

NOTE

- Remove the filler cap to drain the engine oil faster.

4. Install the drain plug again.
5. Tighten the 4 bolts to install the cover.
6. Fill the engine oil from the oil filler port up to the maximum level of the engine oil dipstick.



- (4) Engine oil dipstick (a) Correct oil level range
(5) Oil filler port

Recommended oil

Engine oil	7.5 L 2.6 U.S.gals	Above 25 °C (77 °F) API CJ-4 SAE 30 SAE 10W-30 SAE 15W-40
		0 to 25 °C (32 to 77 °F) API CJ-4 SAE 20 SAE 10W-30 SAE 15W-40
		Below 0 °C (32 °F) API CJ-4 SAE 10W SAE 10W-30 SAE 15W-40

- Start the engine in idling speed and leave it for 5 minutes.
- Replenish the engine oil if necessary.

2. Replacing the engine oil filter**⚠ WARNING**

- Keep fire and flammable items away from the working area.

⚠ CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, muffler, and oil are extremely hot.
 - Pressure in the engine oil line is high.

■ IMPORTANT

- Keep dust away from the working area.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

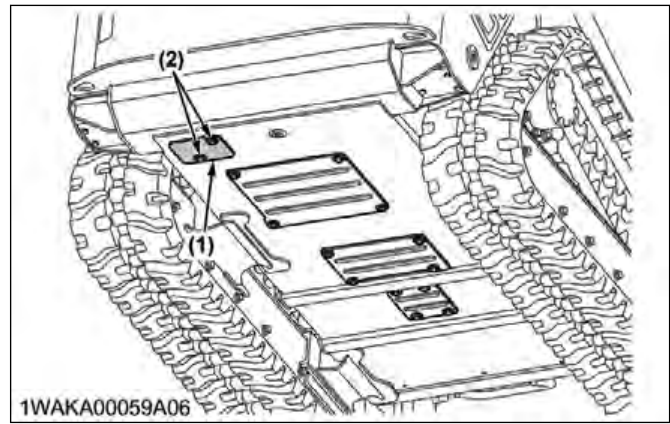
⚠ CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.
- Tilt the radiator.

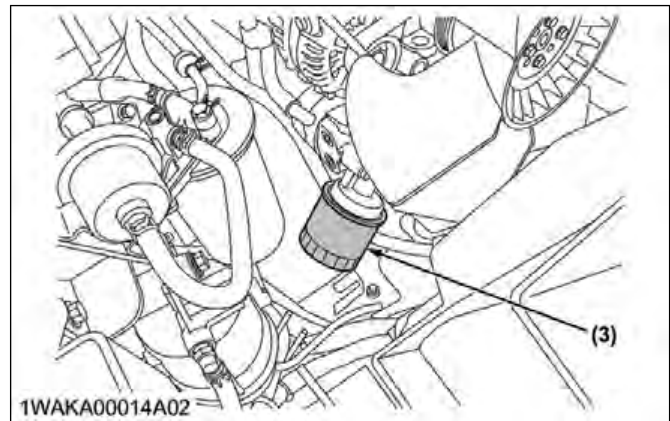
Replacing

- Remove the 2 bolts to remove the cover.



- (1) Cover (2) Bolt (M12 × 30) ×2

- Put a tray under the engine oil filter to receive the engine oil.
- Remove the engine oil filter with a filter wrench.



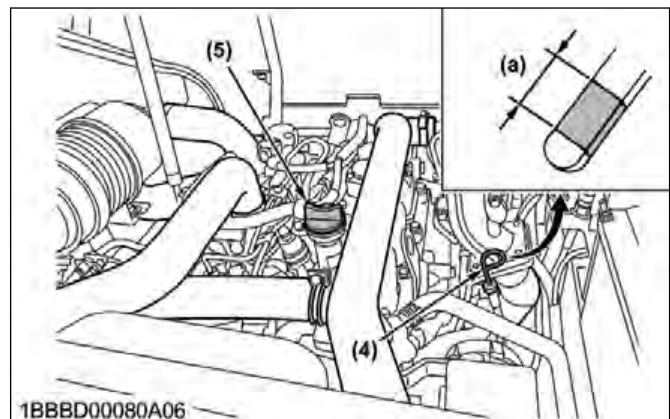
- (3) Engine oil filter

- Apply engine oil to the O-ring and install a new engine oil filter by hand tightening.

■ IMPORTANT

- Do not tighten the engine oil filter strongly with a filter wrench.

- Tighten the 2 bolts to install the cover.
- Check the engine oil level with the engine oil dipstick.



- (4) Engine oil dipstick (a) Correct oil level range
(5) Oil filler port

Recommended oil

Engine oil	7.5 L 2.6 U.S.gals	Above 25 °C (77 °F) API CJ-4 SAE 30 SAE 10W-30 SAE 15W-40
		0 to 25 °C (32 to 77 °F) API CJ-4 SAE 20 SAE 10W-30 SAE 15W-40
		Below 0 °C (32 °F) API CJ-4 SAE 10W SAE 10W-30 SAE 15W-40

7. Start the engine in idling speed and leave it for 5 minutes.
8. Replenish the engine oil if necessary.

3. Replacing the fuel filter

WARNING

- Keep fire and flammable items away from the working area.

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.

■ IMPORTANT

- Keep dust away from the working area.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

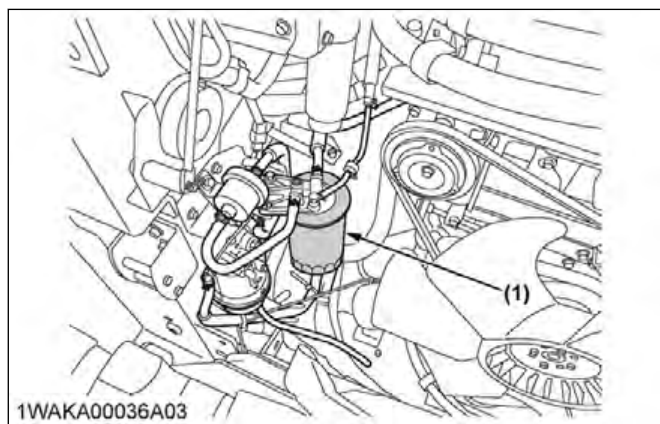
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.

Replacing

1. Remove the fuel filter with a filter wrench.



(1) Fuel filter

2. Apply fuel to the O-ring and install a new fuel filter by hand tightening.

■ IMPORTANT

- Do not tighten the filter strongly with a filter wrench.

3. Turn the starter switch to [RUN] to bleed the air from the fuel line.

■ IMPORTANT

- Check for fuel leakage from the fuel filter. If there is any leakage, tighten the filter slightly with a filter wrench.

4. Replacing the HST motor gear oil

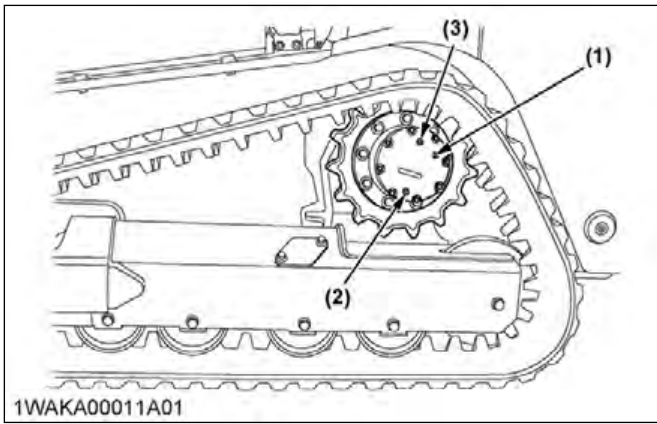
■ IMPORTANT

- Perform the initial replacement 250 hours after starting using this machine.
- Keep dust away from the working area.

1. Travel the machine for a while to warm up the gear oil.

■ NOTE

- It is difficult to drain the gear oil in the case that the gear oil is cold.
2. Travel the machine on the firm and level the ground so that the drain port is in the bottom position.



- (1) Oil check port
(2) Drain port

- (3) Oil filler port

3. Lower the front attachment to the ground, and stop the engine.
4. Put a tray under the drain port to receive the gear oil.
5. Remove the oil filler plug.
6. Remove the oil check plug.
7. Remove the drain plug and drain all gear oil.
8. Install the drain plug with a new O-ring.
9. Replenish gear oil from the oil filler port.

Recommended lubricant

Gear oil	1.0 L 0.3 U.S.gals	API GL-4, GL-5 SAE 90
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10. Check the oil level from the oil check port.
11. Install the oil filler plug and oil check plug with a new O-ring.

5. Replacing the water separator element

WARNING

- Keep fire and flammable items away from the working area.

IMPORTANT

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
- Keep dust away from the working area.
- Do not re-use removed O-rings for assembly to avoid oil leakage.

Preparing

1. Park the machine on the firm and level ground, lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

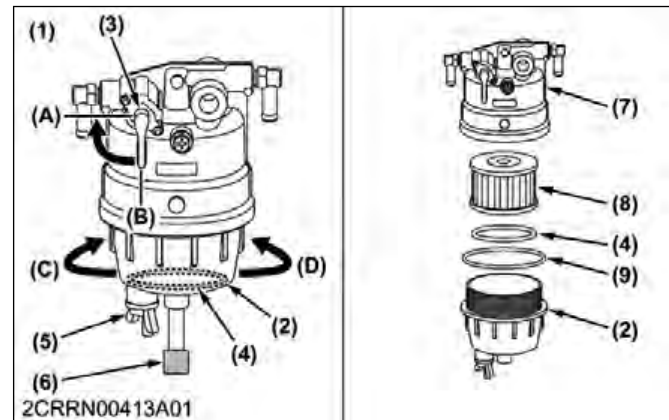
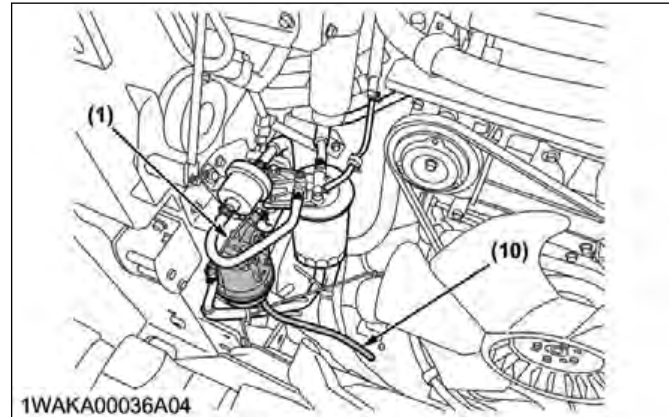
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.

Replacing

1. Disconnect the water level sensor connector.
2. Close the water separator lever.
3. Put a tray under the drain hose to receive fuel.
4. Loosen the drain plug and drain the water.
5. Loosen the cup and replace the water separator element.



- | | |
|----------------------------------|-------------|
| (1) Water separator | (9) O-ring |
| (2) Cup | (10) Hose |
| (3) Water separator lever | (A) Close |
| (4) Float | (B) Open |
| (5) Drain plug | (C) Loosen |
| (6) Water level sensor connector | (D) Tighten |
| (7) Head cover | |
| (8) Water separator element | |

6. Tighten the cup.
7. Open the water separator lever.
8. Bleed the air from the fuel line.

6. Replacing the return filter

WARNING

- Keep fire and flammable items away from the working area.

CAUTION

- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

■ IMPORTANT

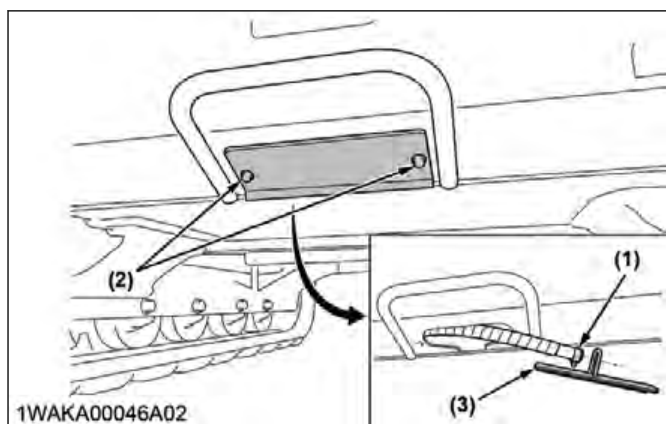
- Perform the initial replacement 250 hours after starting using this machine.
- Keep dust away from the working area.
- Do not reuse removed O-rings for assembly to avoid oil leakage.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Release the residual pressure.
3. Install a vacuum pump to the hydraulic tank and vacuum the hydraulic tank.
4. Tilt up the cab.

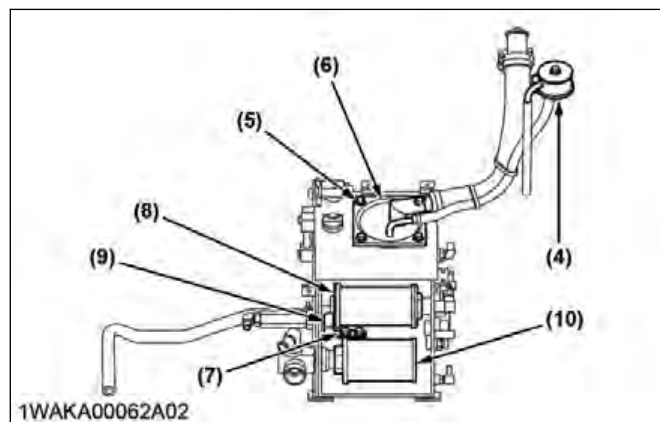
Replacing

1. Put a tray under the return filter to receive the hydraulic oil.
2. Remove the 2 bolts and the cover.
3. Remove the drain plug and drain the hydraulic oil.



- (1) Drain plug (3) Cover
(2) Bolt (M8 × 20) × 2

4. Remove the 4 bolts and the cover.
5. Remove the 2 bolts and the filter stopper.
6. Remove the return filter.



- (4) Breather filter (8) Return filter
(5) Bolt (M10 × 20) × 4 (9) Filter stopper
(6) Cover (10) Suction filter
(7) Bolt (M8 × 20) × 4

7. Install a new return filter.

■ NOTE

- Apply hydraulic oil to the gasket of the new return filter.
- Do not tighten the filter strongly with a filter wrench.

Tightening torque

(8) Return filter	50.0 to 70.0 N·m 5.1 to 7.1 kgf·m 36.9 to 51.6 lbf·ft
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8. Install the 2 bolts and the filter stopper.
9. Install the 4 bolts and the cover.
10. Install the drain plug again.
11. Install the 2 bolts and the cover.
12. Fill hydraulic oil from the oil filler port up to the center of the gauge.

■ IMPORTANT

- Clean the surface of the hydraulic oil tank around the oil filler port before replenishing the hydraulic oil to avoid dust contamination.
- Do not use mixed or different oil.

Recommended lubricant

Hydraulic oil	35 L 9.3 U.S.gals
---------------	----------------------

13. Start the engine and move the control lever to the end and hold it for approximately 5 minutes to bleed air in the hydraulic circuit.
14. Operate the machine to the hydraulic oil level check position.
15. Check the hydraulic oil level and replenish it if necessary.

7. Replacing the breather filter

WARNING

- Keep fire and flammable items away from the working area.

CAUTION

- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

■ IMPORTANT

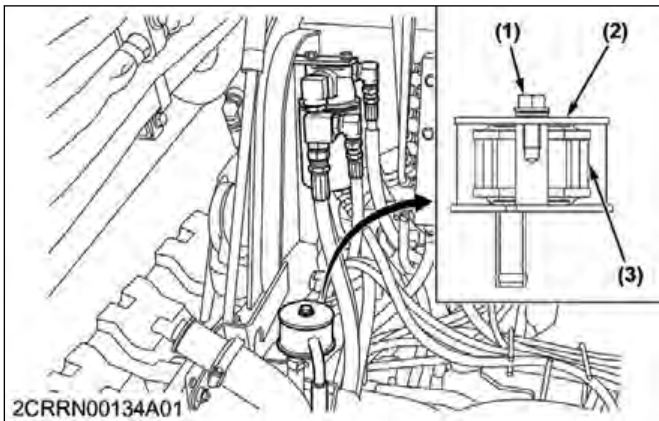
- Keep dust away from the working area.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Install a vacuum pump to the hydraulic tank and vacuum the hydraulic tank.
3. Tilt up the cab.

Replacing

1. Remove the bolt to remove the cover.



- (1) Bolt (M8 × 12) (3) Breather filter
(2) Cover

2. Remove the breather filter and replace with a new one.
3. Tighten the bolt to install the cover.

8. Replacing the HST filter

WARNING

- Keep fire and flammable items away from the working area.

■ IMPORTANT

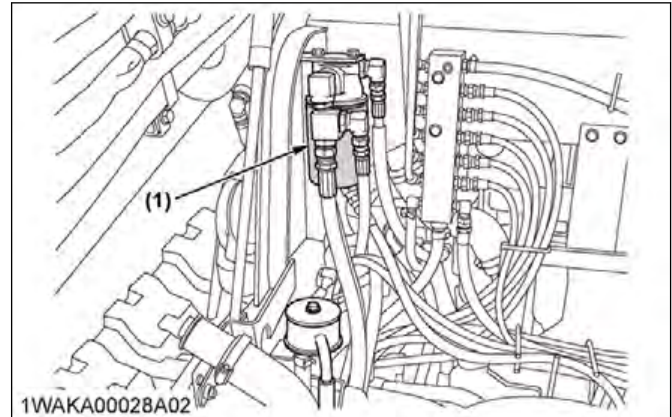
- Perform the initial replacement 50 hours after starting using this machine.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Install a vacuum pump to the hydraulic tank and vacuum the hydraulic tank.
3. Tilt up the cab.

Replacing

1. Put a tray under the HST filter to receive oil.
2. Remove the HST filter with a wrench.



- (1) HST filter

3. Apply hydraulic oil to the O-ring of a new HST filter and install it.

Tightening torque

(1) HST filter	39.2 to 45.1 N · m 4.0 to 4.6 kgf · m 29.0 to 33.2 lbf · ft
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4. Fill the hydraulic oil from the oil filler port up to the center of the gauge.

■ IMPORTANT

- Clean the surface of the hydraulic oil tank around the oil filler port before replenishing the hydraulic oil to avoid dust contamination.
- Do not use mixed or different oil.

Recommended lubricant

Hydraulic oil	35 L 9.3 U.S.gals
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9. Replacing the fan belt

WARNING

- Keep fire and flammable items away from the working area.

CAUTION

- Stop the engine, remove the key, and hang a DO NOT OPERATE tag near the operator's seat

when checking, adjusting or replacing the fan belt or the air conditioning belt.

■ IMPORTANT

- Keep dust away from the working area.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



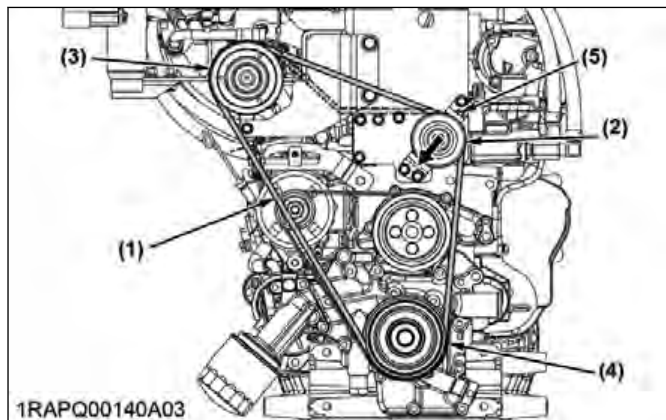
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.
5. Remove the fan.

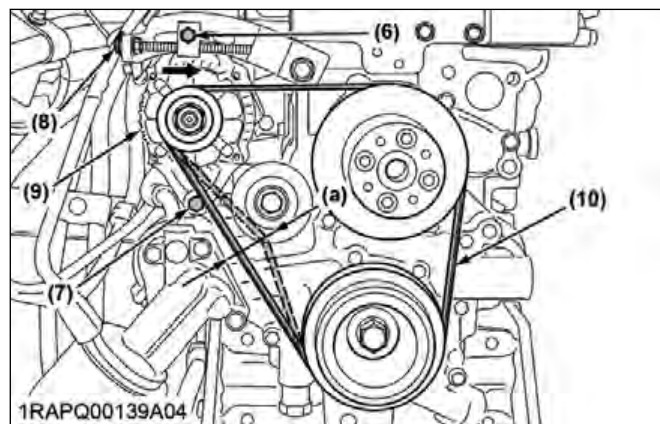
Replacing

1. Loosen the tension bolt, and move the tension pulley to the direction of the wide arrow to remove the air conditioning belt.



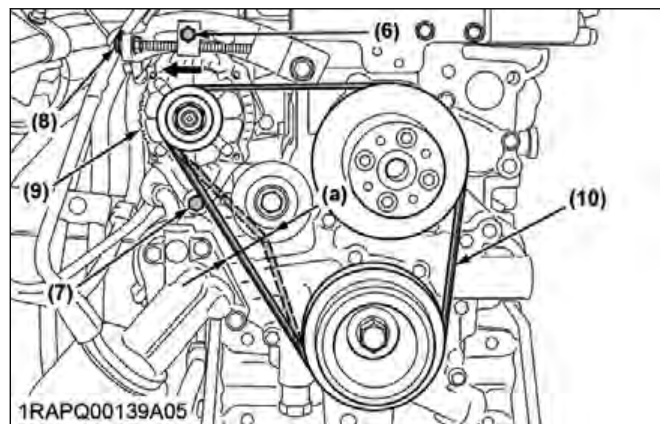
- (1) Air conditioning belt
- (2) Tension pulley
- (3) Compressor
- (4) Pulley
- (5) Tension bolt

2. Loosen the 2 bolts and the adjuster bolt.
3. Move the alternator to the direction of the wide arrow to remove the fan belt.



- (6) Bolt
- (7) Bolt
- (8) Adjustment bolt
- (9) Alternator
- (10) Fan belt

4. Replace the fan belt with a new one.
5. Move the alternator to the direction of the wide arrow and tighten the 2 bolts and the adjustment bolt.
6. Push position (a) to check the fan belt tension.



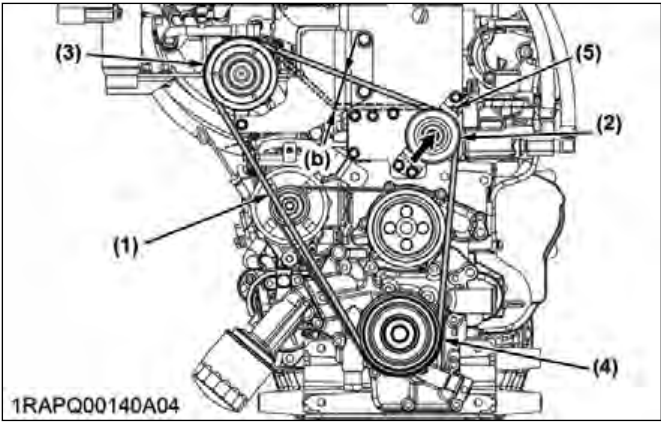
- (6) Bolt
- (7) Bolt
- (8) Adjustment bolt
- (9) Alternator
- (10) Fan belt

Service specification

(a) Fan belt tension	4.0 to 5.0 mm 0.16 to 0.20 in.	Push with 50 to 60 N
		Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf

7. Set the air conditioning belt.
8. Tighten the tension bolt.

3. MAINTENANCE



- (1) Air conditioning belt
- (2) Tension pulley
- (3) Compressor
- (4) Pulley
- (5) Tension bolt

9. Push position (b) to check the air conditioning belt tension.

Service specification

(b) Air conditioning belt tension	7.0 to 9.0 mm 0.27 to 0.35 in.	Push with 50 to 60 N Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf
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10. Start the engine and check for the slip of the fan belt and the air conditioning belt.

■ IMPORTANT

- The warning lamp will be displayed if running the engine with loose belt.

EVERY 1000 HOURS

1. Replacing the suction filter



WARNING

- Keep fire and flammable items away from the working area.



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, muffler, and oil are extremely hot.
 - Pressure in the engine oil line is high.

■ IMPORTANT

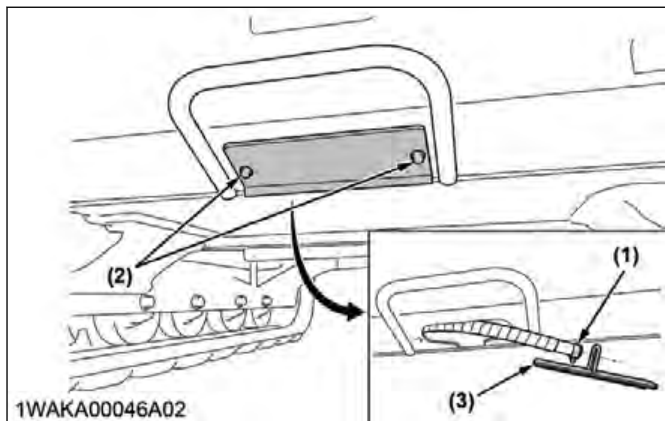
- Keep dust away from the working area.
- Do not re-use removed O-rings for assembly to avoid oil leakage.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Release the residual pressure.
3. Install a vacuum pump to the hydraulic tank and vacuum the hydraulic tank.
4. Tilt up the cab.

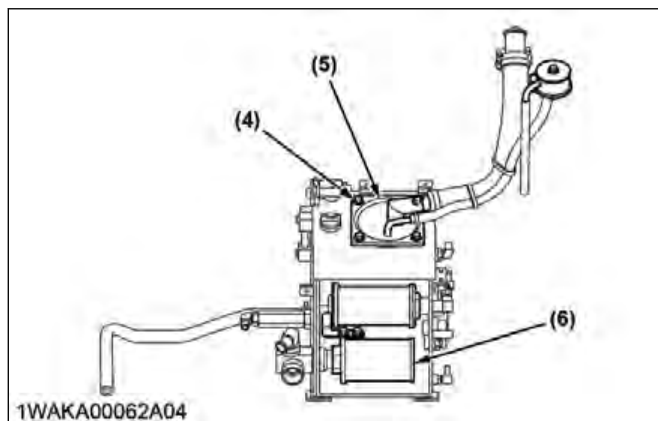
Replacing

1. Put a tray under the suction filter to receive the hydraulic oil.
2. Remove the 2 bolts and the cover.
3. Remove the drain plug and drain the hydraulic oil.



- (1) Drain plug
(2) Bolt (M8 × 20) × 2
(3) Cover

4. Remove the 4 bolts and the cover.
5. Remove the suction filter.



- (4) Bolt (M10 × 20) × 4
(5) Cover
(6) Suction filter

6. Install a new suction filter.

■ NOTE

- Apply hydraulic oil to the gasket of the new suction filter.
- Do not tighten the filter strongly with a filter wrench.

Tightening torque

(6) Suction filter	30.0 to 50.0 N·m 3.1 to 5.1 kgf·m 22.1 to 36.9 lbf·ft
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7. Install the 4 bolts and the cover.
8. Install the drain plug again.
9. Install the 2 bolts and the cover.
10. Fill the hydraulic oil from the oil filler port up to the center of the gauge.

■ IMPORTANT

- Clean the surface of the hydraulic oil tank around the oil filler port before replenishing the hydraulic oil to avoid dust contamination.
- Do not use mixed or different oil.

Recommended lubricant

Hydraulic oil	35 L 9.3 U.S.gals
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11. Start the engine, and move the control lever to the end and hold it for approximately 5 minutes to bleed air in the hydraulic circuit.
12. Operate the machine to the hydraulic oil level check position.
13. Check the hydraulic oil level and replenish it if necessary.

2. Replacing the hydraulic oil

WARNING

- Keep fire and flammable items away from the working area.

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, muffler, and oil are extremely hot.
 - Pressure in the engine oil line is high.

IMPORTANT

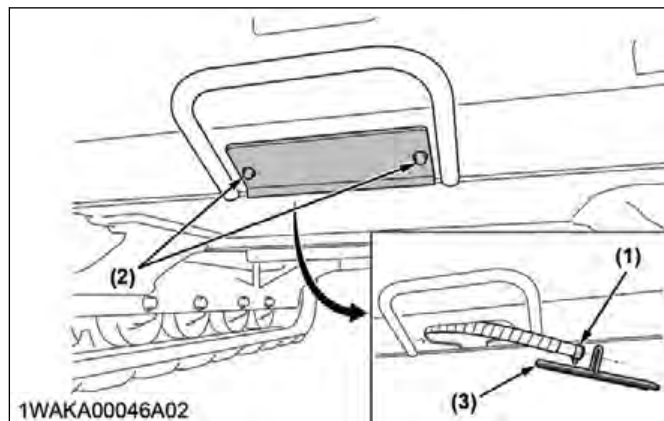
- Keep dust away from the working area.
- Do not re-use removed O-rings for assembly to avoid oil leakage.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Release the residual pressure.
3. Install a vacuum pump to the hydraulic tank and vacuum the hydraulic tank.
4. Tilt up the cab.

Replacing

1. Put a tray under the suction filter to receive the hydraulic oil.
2. Remove the 2 bolts and the cover.
3. Remove the drain plug and drain the hydraulic oil.

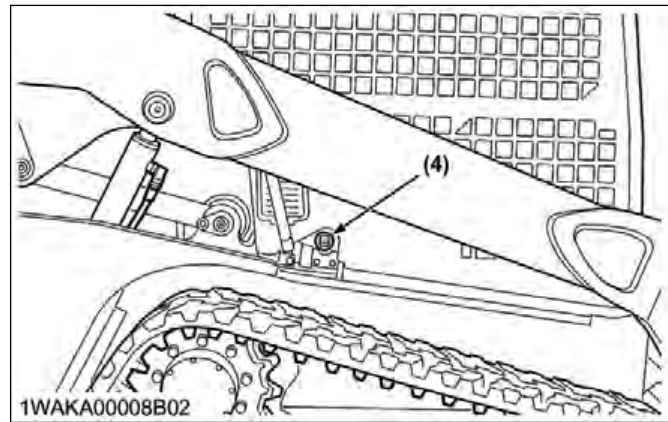


- (1) Drain plug (3) Cover
(2) Bolt (M8 × 20) × 2

4. Install the drain plug again.
5. Install the 2 bolts and the cover.
6. Fill the hydraulic oil from the filling port up to the center of the gauge.

IMPORTANT

- Clean the surface of the hydraulic oil tank around the oil filler port before replenishing the hydraulic oil to avoid dust contamination.
- Do not use mixed or different oil.



(4) Hydraulic oil tank cap

Recommended lubricant

Hydraulic oil	35 L 9.3 U.S.gals
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7. Start the engine, and move the control lever to the end and hold it for approximately 5 minutes to bleed air in the hydraulic circuit.
8. Operate the machine to the hydraulic oil level check position.
9. Check the hydraulic oil level and replenish it if necessary.

EVERY 1500 HOURS

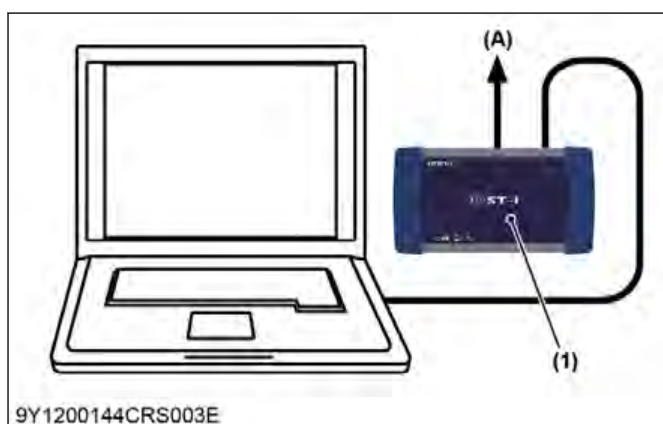
1. Checking the injector

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Checking

1. Use the Diagmaster to perform the following tasks.
 - “#1 Cylinder Injector Injection Stop”.
 - “#2 Cylinder Injector Injection Stop”.
 - “#3 Cylinder Injector Injection Stop”.
 - “#4 Cylinder Injector Injection Stop”.



(1) DST-i

(A) Service tool connector

2. Replacing the oil separator element

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

IMPORTANT

- Work at clean work space with clean tools and lubricant to avoid dust contamination.
- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.
- Install plugs or covers to the removed fuel hoses, radiator hoses, and air conditioning hoses to avoid dust contamination.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

2. Open the rear bonnet and insert the pin into the lock position.



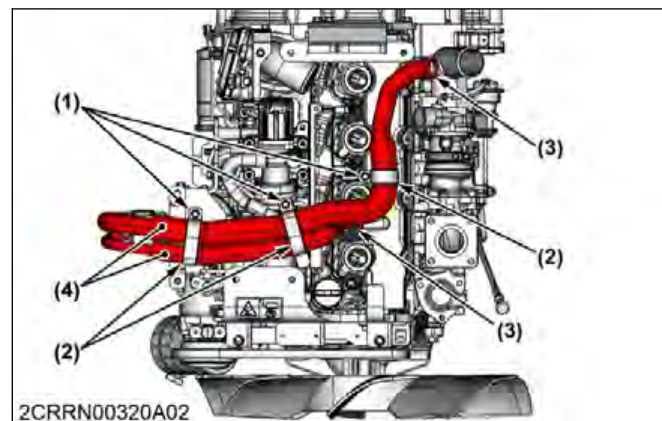
CAUTION

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Tilt the radiator and oil cooler.
5. Vacuum the refrigerant from the cooling circuit.
6. Remove the upper bonnet.
7. Remove the receiver.
8. Remove the DPF muffler.

Replacing

1. Remove the 3 bolts to remove the 3 hose clamps.
2. Remove the 2 hose clamps to remove the 2 heater hoses on the engine side.



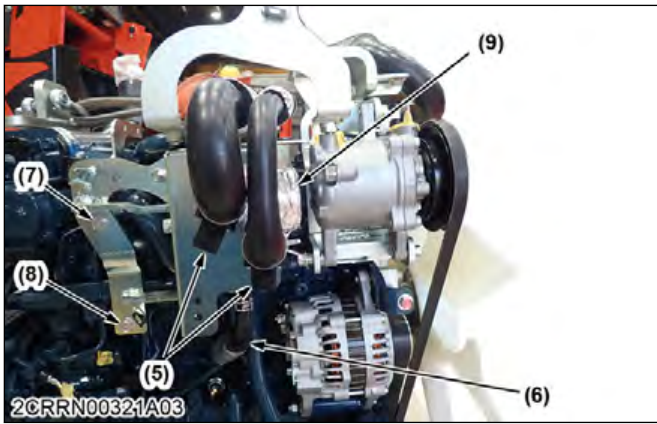
(1) Bolt (M6 × 12) ×3

(4) Heater hose ×2

(2) Hose clamp ×3

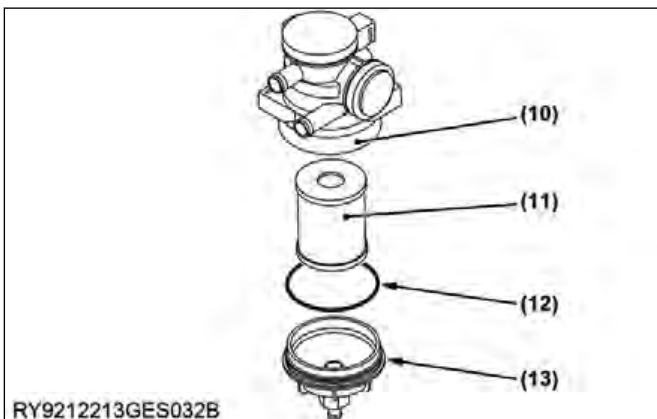
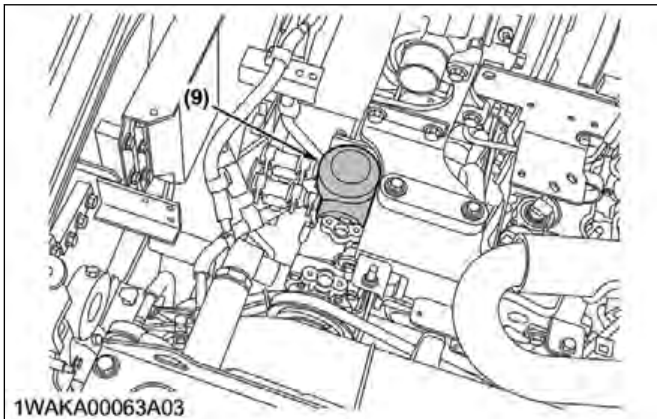
(3) Hose clamp ×2

3. Disconnect the 2 connectors and hose from the oil separator.
4. Remove the 2 bolts to remove the oil separator.



- (5) Connector ×2
(6) Hose
(7) Bolt (M8 × 50)
(8) Bolt (M8 × 60)
(9) Oil separator

5. Put a tray under the oil separator to receive the oil.
6. Remove the cover and the oil separator element.
7. Wipe off oil and carbon inside the case with a waste cloth.
8. Install a new oil separator element and a O-ring.
9. Tighten the cover until it comes in contact with the body.



- (9) Oil separator
(10) Body
(11) Element
(12) O-ring
(13) Cover

3. Checking the EGR cooler

⚠ CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

■ IMPORTANT

- Install plugs or covers to the removed EGR cooler hoses and heater hoses to avoid oil leakage and dust contamination.
- Do not reuse the used gasket of the EGR cooler.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

⚠ CAUTION

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Install a vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
5. Tilt the radiator and oil cooler.
6. Remove the upper bonnet.
7. Remove the receiver.
8. Remove the DPF muffler.

Checking

1. Remove the EGR cooler.
2. Attach the 2 test hoses to the coolant inlet and outlet.
3. Plug the test hose of the coolant outlet side.
4. Put the EGR cooler in a water.
5. Apply air pressure from the air hose and check for air leakage.

■ NOTE

- The air pressure should be 250 kPa (2.5 kgf/cm², 36 psi).



- (1) EGR cooler (B) Plug
(A) Test hose x2

6. Replace the EGR cooler if air leakage is found.

EVERY 2000 HOURS

1. Checking the starter motor



WARNING

- Do not clamp the electrical wiring to fuel hoses.



CAUTION

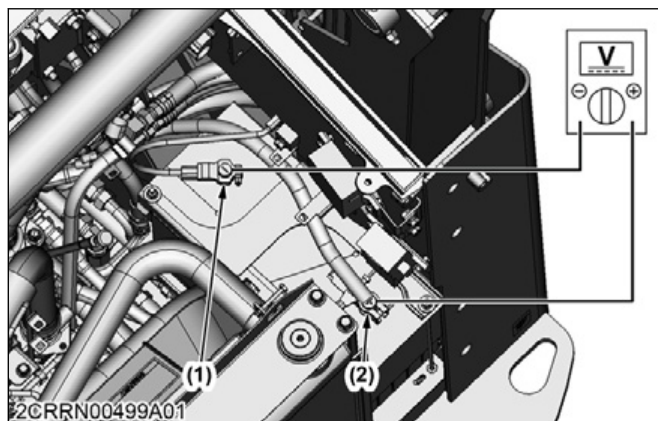
- Do not modify the electrical devices or wiring.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Checking the starter motor

1. Start the engine to check the starter motor.
2. If the starter motor does not operate, see the engine WSM to repair or replace the starter motor.



(1) Negative (-) terminal

(2) Positive (+) terminal

Battery voltage	Engine stopped	Engine running
	12.0 V	Approximately 14.0 V

2. Checking the alternator



WARNING

- Do not remove the vent caps while the engine is running.
- Keep electrolyte away from your eyes, hands, and clothing. Sulfuric acid in the battery electrolyte is poisonous and it can burn your skin and clothing and cause blindness. If you spill electrolyte on yourself, rinse with water and get medical aid immediately.
- Do not use metal tools when cleaning battery terminals. It may cause short circuit.



CAUTION

- Keep a fire (welding sparks, grinding sparks, cigarettes) away from the battery. The battery produces oxygen and hydrogen gases which are flammable.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Check the battery condition.

Checking

1. Check the battery voltage with a multimeter in each case when the engine is running and when it is stopped.

EVERY 3000 HOURS

1. Checking the EGR valve



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

■ IMPORTANT

- Install plugs or covers to the removed hoses to avoid oil leakage and dust contamination.
- Do not reuse the used gasket of the EGR valve.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



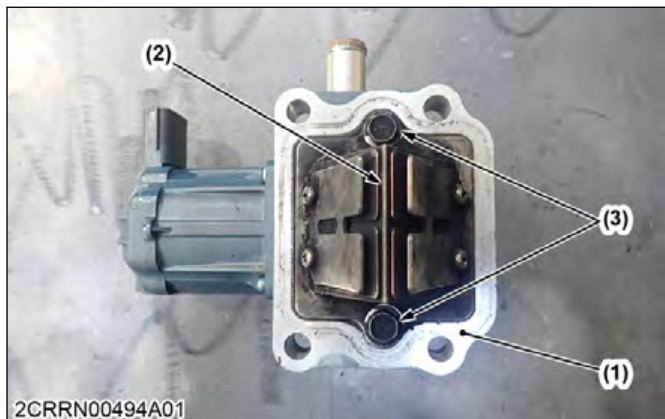
CAUTION

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Install a vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
5. Tilt the radiator and oil cooler.
6. Remove the upper bonnet.
7. Remove the receiver.
8. Remove the DPF muffler.
9. Remove the EGR valve.

Checking

1. Remove the 2 bolts to remove the reed valve.



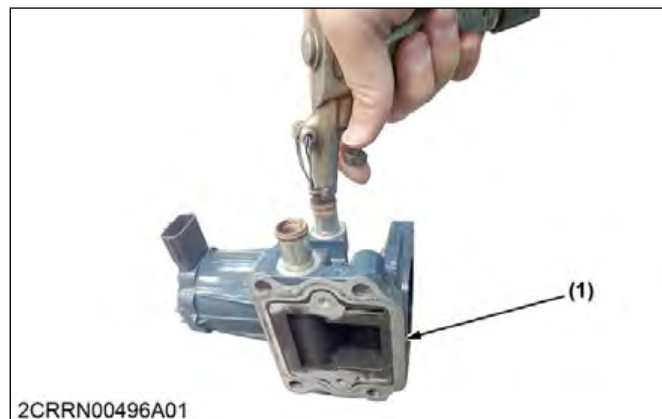
- (1) EGR valve
(2) Reed valve
(3) Bolt (M6) x2

2. Check the EGR valve and reed valve for crack and abnormal wear, and replace them if necessary.



- (1) EGR valve
(2) Reed valve

3. Apply air pressure from the coolant passage and check for air leakage.



- (1) EGR valve

Installing

Tightening torque

(3) Bolt	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft	—
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2. Checking the turbocharger



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Do not install the fuel hose as described below:

- Making it contact sharp edges, high temperature parts, or rotating parts.
- Stretching excessively, deforming, or clamping with electrical wiring.
- Keep fire and flammable items away from the working area.

IMPORTANT

- Install plugs to removed adapters to avoid oil leakage and dust contamination.
- Install plugs or covers to the removed fuel hoses, radiator hoses, intake air line, and air conditioning hoses to avoid dust contamination.
- Do not reuse the used gasket of the turbocharger and the exhaust manifold.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

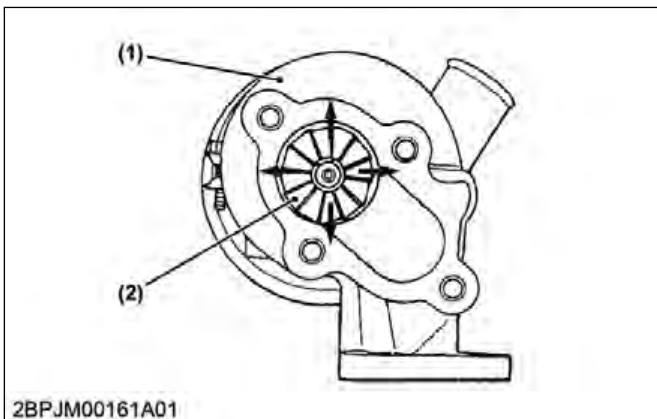
**CAUTION**

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Remove the upper bonnet.
5. Remove the DPF muffler.
6. Remove the turbocharger.

Checking

1. Check the turbine housing and turbine wheel for damage and replace them if necessary.
2. Check if the turbine wheel is jammed and replace the turbocharger assembly if necessary.
3. Check if the turbine wheel contacts the turbine housing and replace the turbocharger assembly if necessary.



(1) Turbine housing

(2) Turbine wheel

3. Cleaning the DPF muffler**Preparing**

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

**CAUTION**

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Remove the DPF muffler.

Cleaning

1. Refer to "DPF HANDLING MANUAL (FOR COMPACT TRACK LOADER)" for disassemble and cleaning process of the DPF muffler.



(1) DPF

Assembling

1. Refer to "DPF HANDLING MANUAL (FOR COMPACT TRACK LOADER)" to assemble the DPF muffler.

Concluding

1. Perform the following tasks on the Diagmaster.
 - "DPF Soot Load Reset"
 - "Auto Regeneration Inhibit Time Reset"
 - "DPF Regeneration Interval Time Reset"
 - "DPF Manual Regeneration Request Function"
2. Click the following check boxes, input the hour meter, serviced date, and sign up to the K-ISS.
 - "Input of Clean and Return"
 - "Cleaning Completed DPF Component"

EVERY 1 YEAR

1. Checking the exhaust gas line

⚠ CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

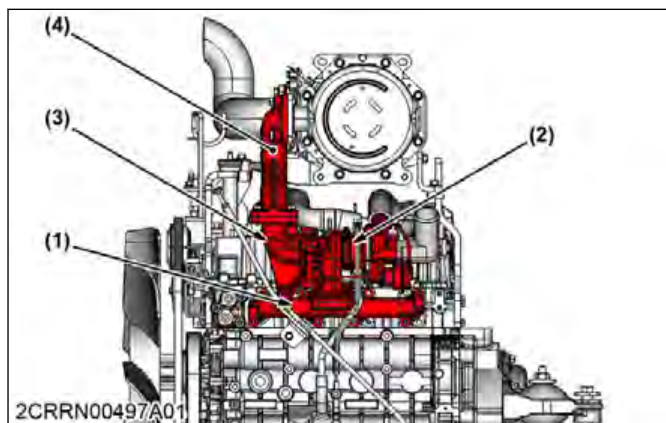
⚠ CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator and oil cooler.

Checking

1. Check the bolts and nuts for any looseness and tighten them if necessary.
2. Apply gas leak detection solution to the exhaust manifold, turbocharger, and 2 muffler flanges.
3. Start the engine to check for exhaust gas leakage and replace the damaged parts or gaskets if necessary.



- (1) Exhaust manifold
- (2) Turbocharger
- (3) Muffler flange
- (4) Muffler flange

2. Checking the intake air line

⚠ CAUTION

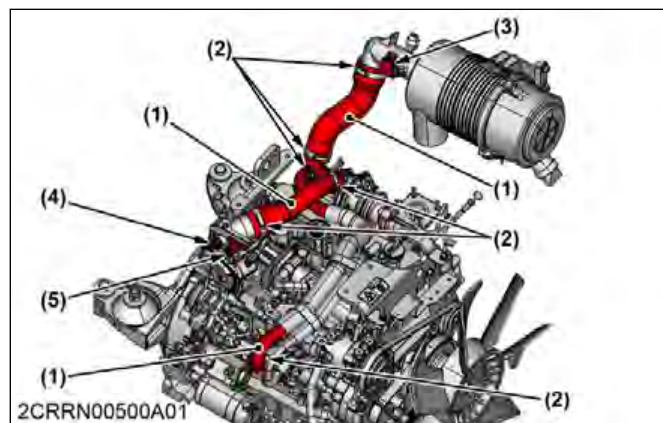
- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Checking

1. Apply gas leak detection solution to the 3 intake air hoses.
2. Start the engine to check for intake air leakage and replace the damaged parts if necessary.
3. Check the bolts that fix the hose clamps for any looseness and tighten them if necessary.
4. Check the air flow sensor, air temperature sensor, and boost sensor, and replace them if necessary.
5. Check the bolts that fix the sensors for any looseness and tighten them if necessary.
6. Check the wire harnesses and replace them if necessary.



- (1) Intake air hose ×3
- (2) Hose clamp ×6
- (3) Air flow sensor
- (4) Air temperature sensor
- (5) Boost sensor

3. Checking the DPF muffler

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

3. MAINTENANCE



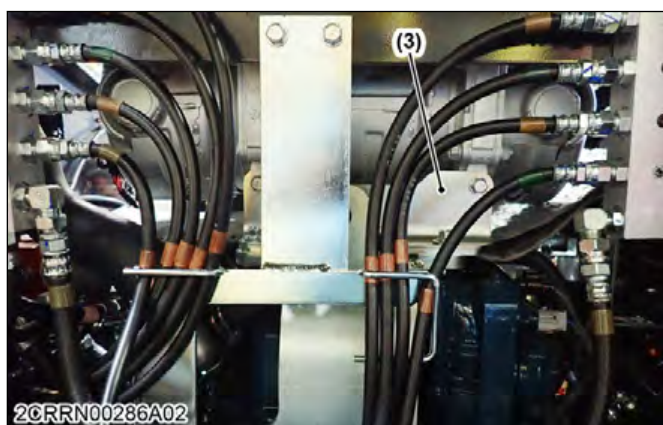
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the cab.

Checking

1. Check the DPF muffler and brackets for any crack.
2. Check the bolts that fix the bracket for any looseness.



- (1) DPF muffler
- (2) Bracket
- (3) Bracket

3. Check the temperature sensors and the differential pressure sensor, and replace them if necessary.
4. Check the bolts that fix the sensors for any looseness and tighten them if necessary.
5. Check the wire harnesses and replace them if necessary.



- (4) DOC inlet temperature sensor (T0)
- (5) DPF inlet temperature sensor (T1)
- (6) Differential pressure sensor (ΔP)
6. Apply gas leak detection solution to the DPF muffler, DPF exhaust pipe and the differential pressure sensor pipes.
7. Start the engine to check for the exhaust gas leakage and replace the damaged parts or gaskets if necessary.
- (7) DPF outlet temperature sensor (T2)



- (8) DPF exhaust pipe
- (9) Differential pressure pipe ×2

4. Checking the EGR and EGR piping



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



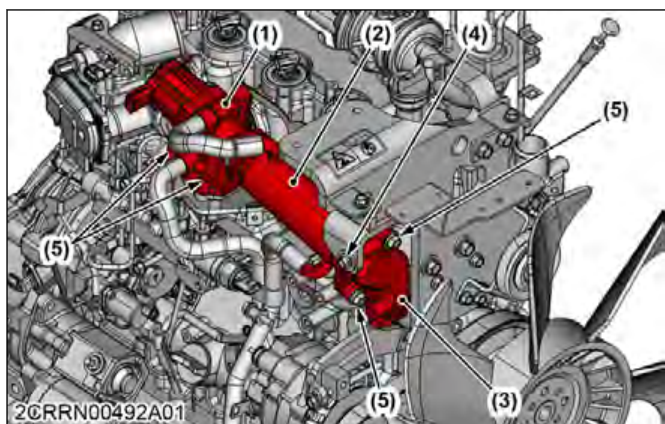
CAUTION

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Install a vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
5. Tilt the radiator and oil cooler.
6. Remove the upper bonnet.
7. Remove the DPF muffler.

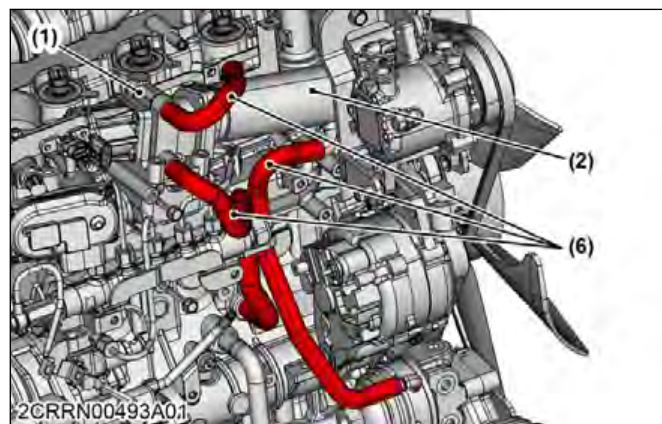
Checking

1. Check the EGR valve and replace it if necessary.
2. Check the bolts that fix the EGR valve, the EGR cooler, and the flange for any looseness and tighten them if necessary.



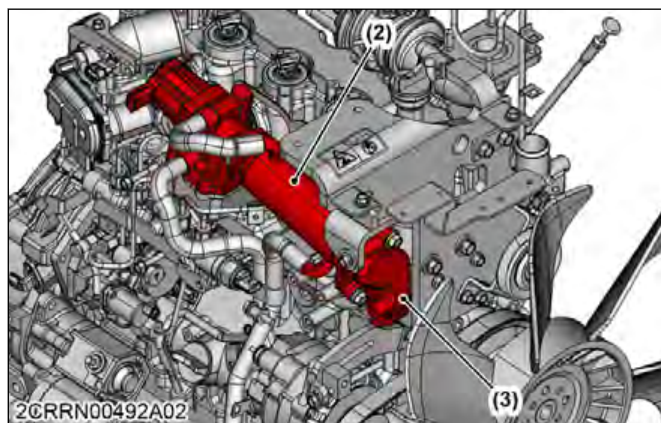
- (1) EGR valve (2) EGR cooler (3) Flange (4) Bolt (M8 × 20) (5) Bolt (M10 × 35) × 8

3. Check the cooler hoses and hose clamps, and replace them if necessary.



- (1) EGR valve (2) EGR cooler (6) Cooler hose × 3

4. Apply gas leak detection solution to the EGR cooler and the flange.



- (2) EGR cooler (3) Flange

5. Start the engine to check for the exhaust gas leakage, and replace the damaged parts or gaskets if necessary.

Installing

Tightening torque

(4) Bolt	24 to 27 N · m 2.4 to 2.8 kgf · m 18 to 20 lbf · ft	—
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5. Checking the CCV heater



WARNING

- Do not touch engine components (except CCV heater) because they are extremely hot.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

3. MAINTENANCE



CAUTION

- Check that the rear bonnet is securely locked.

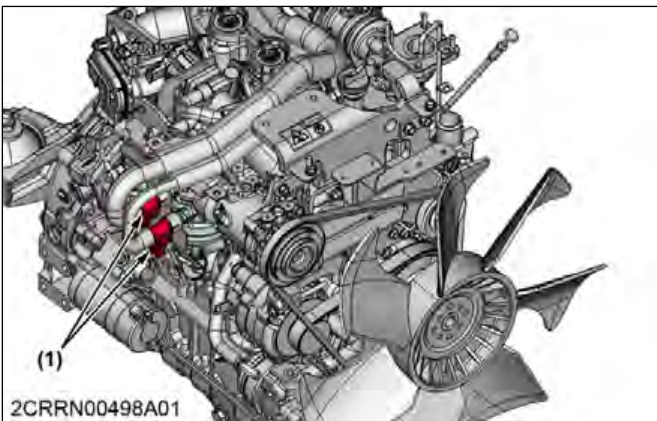
3. Open the upper bonnet.

Checking

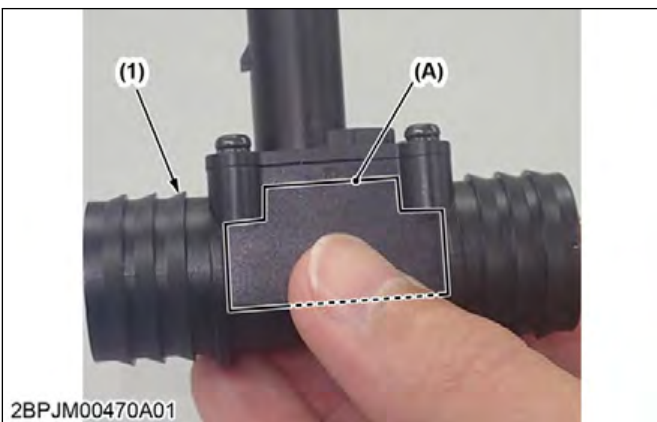
1. Turn the starter switch to the **[RUN]** position and leave it for 1 minute.
2. Turn the starter switch to the **[STOP]** position.
3. Check the CCV heater by touching the CCV heater cases. See the figure below for the touching area.

NOTE

- If the CCV heaters are working, the temperature inside the cases rise to approximately 70 °C (158 °F), and the heater cases become warm.
 - In case that the CCV heater cases are not warm, do not start the engine in an environment below the freezing point.
4. Check the CCV heaters for crack and gas leakage and replace them if necessary.



(1) CCV heater



(1) CCV heater

(A) Touch area

EVERY 2 YEARS

1. Changing the coolant

⚠ CAUTION

- Do not work soon after stopped the engine.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

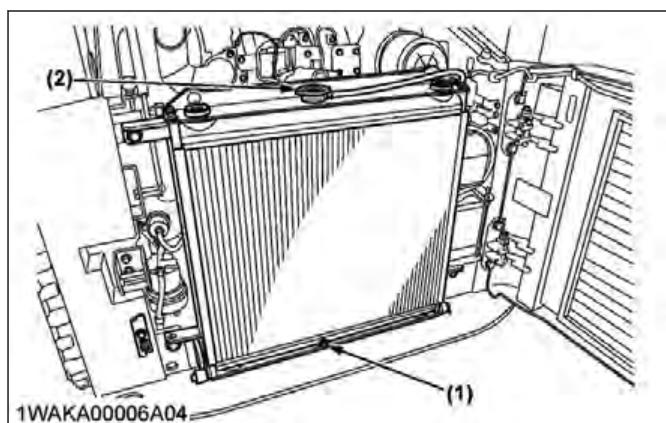
⚠ CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.

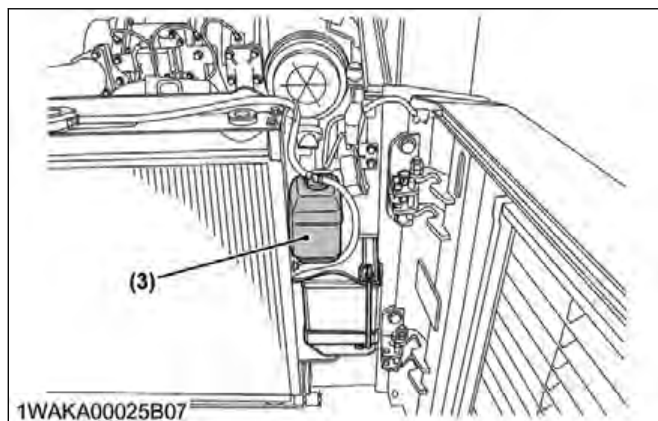
Changing

1. Tilt the radiator and oil cooler.
2. Set an oil pan under the drain plug.
3. Loosen the cap and remove the drain plug to drain the coolant completely.



(1) Drain plug (2) Cap

4. Dispose of the coolant in the reserve tank.



(3) Reserve tank

5. Clean the inside of the radiator with coolant.

■ IMPORTANT

- Do not apply excessive pressure to the radiator to avoid the radiator burst. The coolant pressure inside the radiator must be below 0.9 kgf/cm².

6. Close the drain plug and fill up the radiator with coolant for flushing.
7. Install the radiator cap.
8. Start the engine and keep it idle to flush the coolant circuit.

■ NOTE

- Warm up the coolant until the thermostat opens.
- In the case of the A/C specification, activate the heater.

9. Drain the coolant and fill the radiator with new coolant to flush again.
10. Repeat flushing several times until the drained coolant becomes clean.
11. Close the drain plug and fill up the radiator with new coolant.

■ IMPORTANT

- Do not fill the reserve tank with the coolant exceeding the [FULL] level.
- Do not mix the coolant with dirty or salt water.
- Do not operate the machine without coolant.

Coolant quantity

Radiator	8.5 L 2.2 U.S.gals	50% antifreeze
Reserve tank	1.0 L 0.26 U.S.gals	

2. Replacing the radiator hoses and clamps

WARNING

- Do not open the radiator cap soon after the engine has stopped. There is a possibility of serious burn injury due to the coolant blowing out from the radiator.

CAUTION

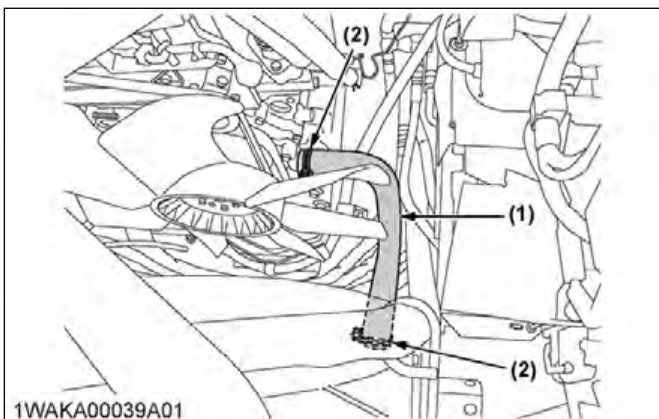
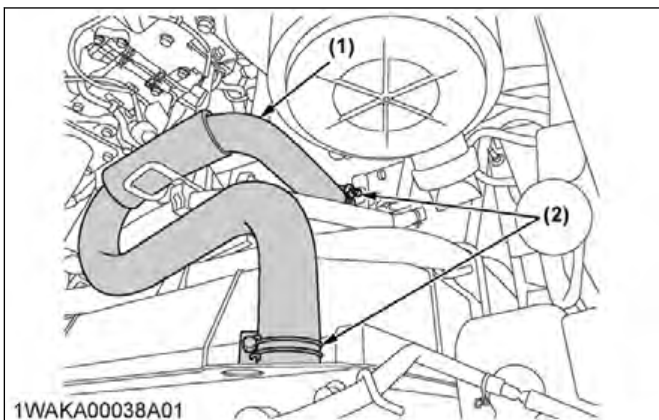
- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.

Preparing

- Park the machine on the firm and level ground, lower the bucket to the ground, and stop the engine.

Replacing

- Drain the coolant.
- Replace the radiator hoses and hose clamps.



- (1) Radiator hose (2) Hose clamp

- Replenish the new coolant.

Coolant quantity

Radiator	8.5 L 2.2 U.S.gals	50% antifreeze
Reserve tank	1.0 L 0.26 U.S.gals	

- Start the engine in idle speed and leave it for 5 minutes.
- Check for leakage of the coolant.
- Check the coolant level.

3. Replacing the oil separator rubber piping

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

IMPORTANT

- Work at clean work space with clean tools and lubricants to avoid dust contamination.
- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.
- Install plugs or covers to the removed fuel hoses, radiator hoses, and air conditioning hoses to avoid dust contamination.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

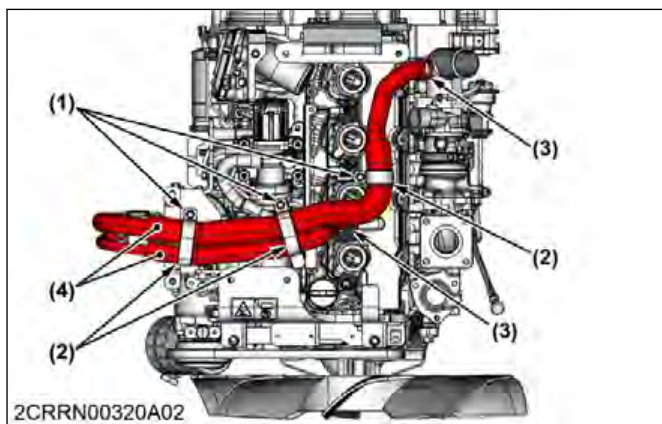
CAUTION

- Check that the rear bonnet is securely locked.

- Disconnect the battery cable from the negative (-) terminal.
- Tilt the radiator and oil cooler.
- Vacuum the refrigerant from the cooling circuit.
- Remove the upper bonnet.
- Remove the receiver.
- Remove the DPF muffler.

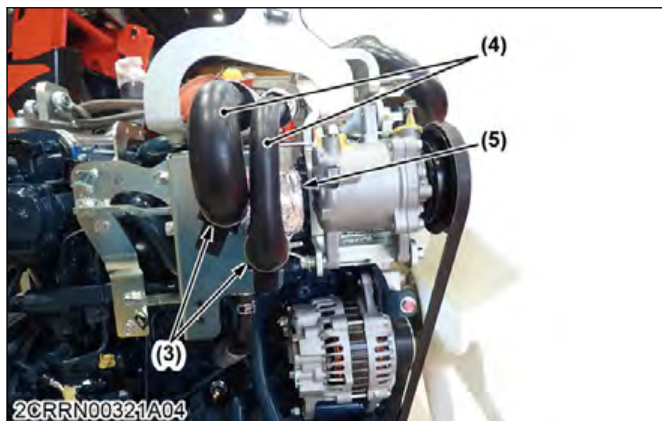
Replacing

- Remove the 3 bolts to remove the 3 hose clamps.
- Remove the 2 hose clamps to remove the 2 heater hoses on the engine side.



- (1) Bolt (M6 × 12) × 3
 (2) Hose clamp × 3
 (3) Hose clamp × 2
 (4) Heater hose × 2

3. Remove the 2 hose clamps to replace the 2 heater hoses with new ones.



- (3) Hose clamp × 2
 (4) Heater hose × 2
 (5) Oil separator

4. Remove the 2 hose clamps to replace the hose with a new one.



- (5) Oil separator
 (6) Hose clamp × 2
 (7) Hose

4. Replacing the DPF differential pressure sensor rubber piping

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



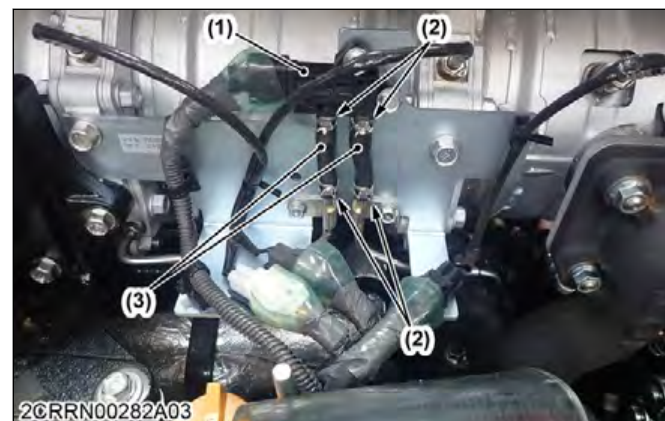
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the cab.

Replacing

1. Remove the 4 hose clamps to replace the 2 differential pressure sensor rubber pipes with new ones.



- (1) Differential pressure sensor
 (2) Hose clamp × 4
 (3) Differential pressure sensor rubber pipe × 2

5. Replacing the fuel line



CAUTION

- Do not work soon after the engine has stopped.
 – Engine, fuel, and oil are extremely hot.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



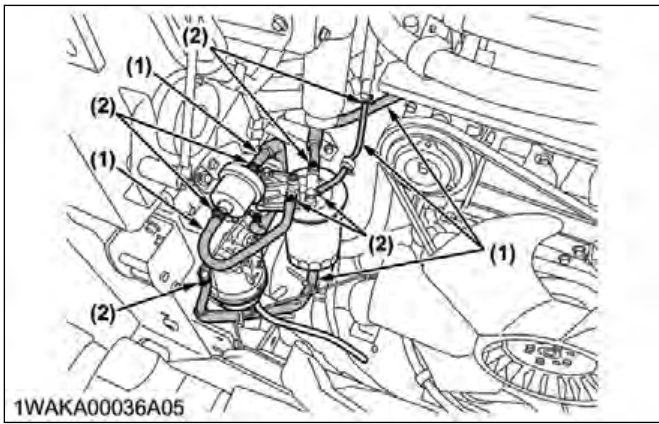
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.

Replacing

1. Replace the fuel hoses.



- (1) Fuel hose (2) Hose clamp

- Turn the starter switch to **[RUN]** to bleed the air from the fuel line.

■ IMPORTANT

- Check for fuel leakage from the fuel hoses. If there is any leakage, tighten the hose clamps.

6. Replacing the intake air line

⚠ CAUTION

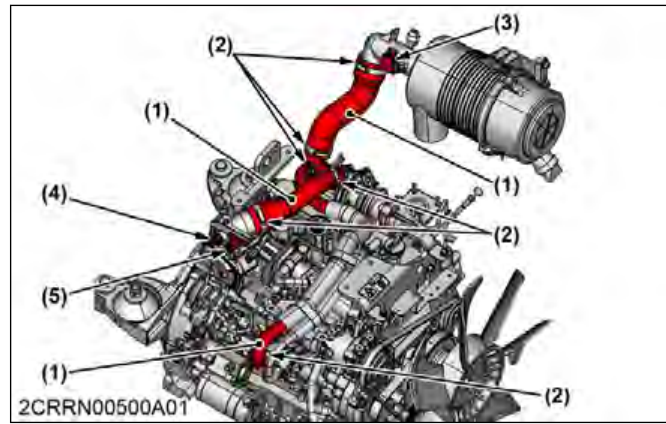
- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.

Preparing

- Lower the front attachment to the ground, and stop the engine.

Replacing

- Replace the intake air hose.
- Check the bolts that fix the hose clamps for any looseness and tighten them if necessary.
- Check the air flow sensor, air temperature sensor, and boost sensor, and replace them if necessary.
- Check the bolts that fix the sensors for any looseness and tighten them if necessary.
- Check the wire harnesses and replace them if necessary.



- (1) Intake air hose (2) Hose clamp (3) Air flow sensor (4) Air temperature sensor (5) Boost sensor

- Apply gas leak detection solution to the boost sensor pressure rubber pipe.
- Start the engine to check for the air leakage and replace the boost sensor pressure rubber pipe if necessary.



- (5) Boost sensor (6) Boost sensor pressure rubber pipe

7. Replacing the EGR cooler hose

⚠ CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

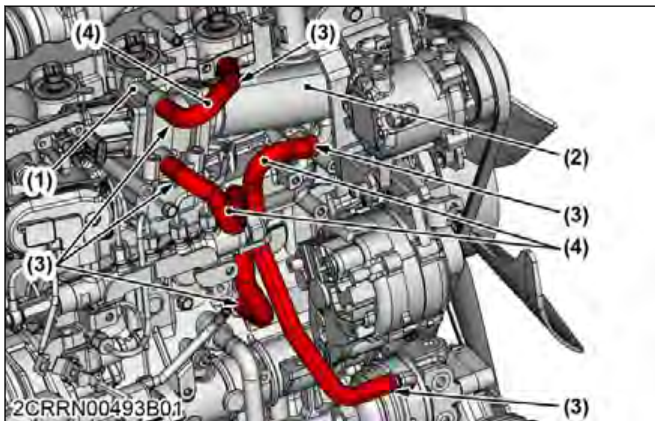
**CAUTION**

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Install a vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
5. Tilt the radiator and oil cooler.
6. Remove the upper bonnet.
7. Remove the DPF muffler.

Replacing

1. Remove the 6 hose clamps to replace the 3 cooler hoses with new ones.



- | | |
|-------------------|--------------------|
| (1) EGR valve | (4) Cooler hose ×3 |
| (2) EGR cooler | |
| (3) Hose clamp ×6 | |

3. MAINTENANCE

MAINTENANCE FOR A/C SPECIFICATION

1. Daily check

1.1 Checking the air conditioning belt

⚠ CAUTION

- Stop the engine, remove the key, and hang a DO NOT OPERATE tag near the operator's seat when checking or adjusting the fan belt and air conditioning belt.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

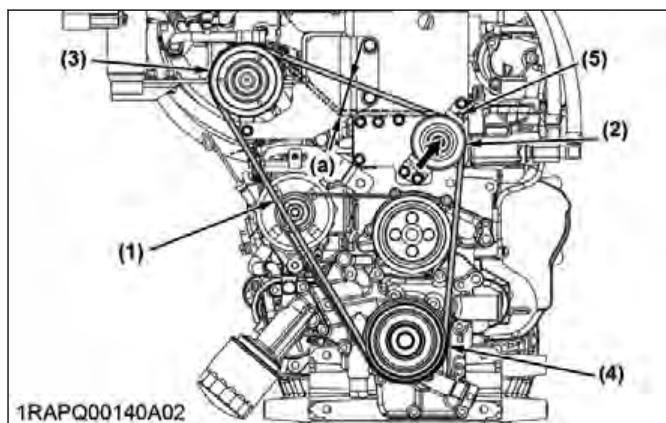
⚠ CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.

Checking

1. Check the fan belt for any crack and damage of the fan belt and replace it if necessary.
2. Push position (a) to check the air conditioning belt tension.



- (1) Air conditioning belt (4) Pulley
(2) Tension pulley (5) Tension bolt
(3) Compressor

3. Adjust the air conditioning belt tension if necessary.

Service specification

(a) Air conditioning belt tension	7.0 to 9.0 mm 0.27 to 0.35 in.	Push with 50 to 60 N Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf
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2. Every 250 hours

2.1 Cleaning the air filter

⚠ CAUTION

- Wear an eye protector when cleaning the air filter with compressed air.

■ IMPORTANT

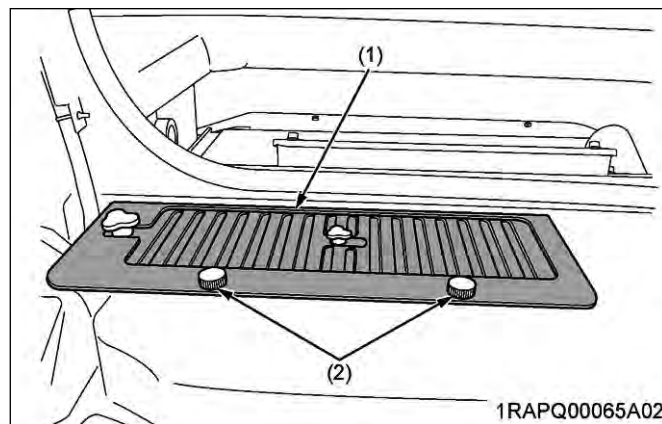
- In the case of using the machine in extremely dusty conditions, check and clean or replace the air filter more frequently.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Cleaning

1. Remove the 2 screws to remove the air filter.

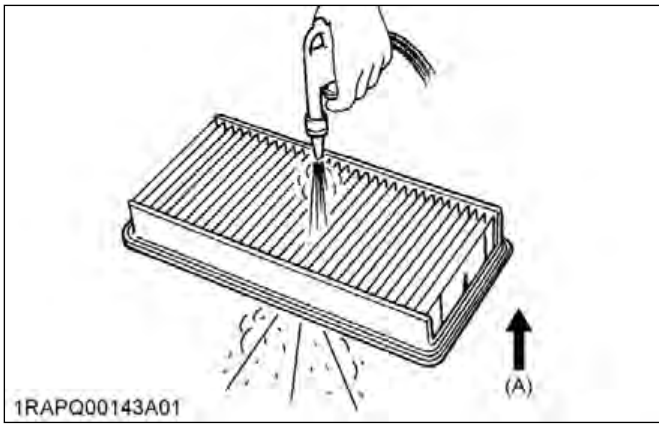


- (1) Cover (2) Screw ×2

2. Clean the air filter with compressed air from the direction opposite of the intake air flow.

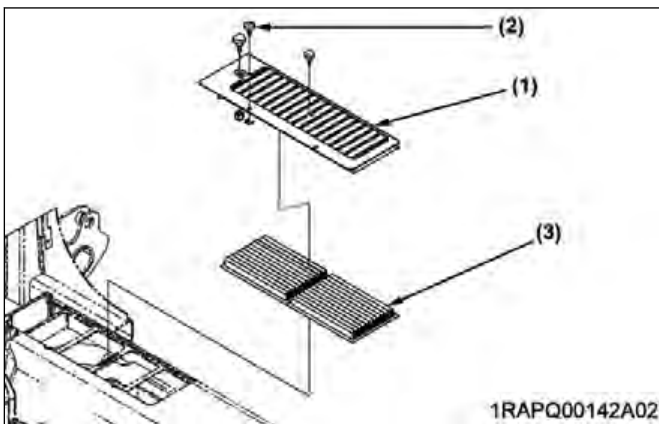
■ IMPORTANT

- Pressure of the compressed air must be under 205 kPa (2.1 kg/cm², 30 psi).



(A) Intake air flow

3. Install the air filter.



(1) Cover
(2) Screw ×2

(3) Air filter

2.2 Checking the condenser

CAUTION

- Wear an eye protector when cleaning the air filter with compressed air.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

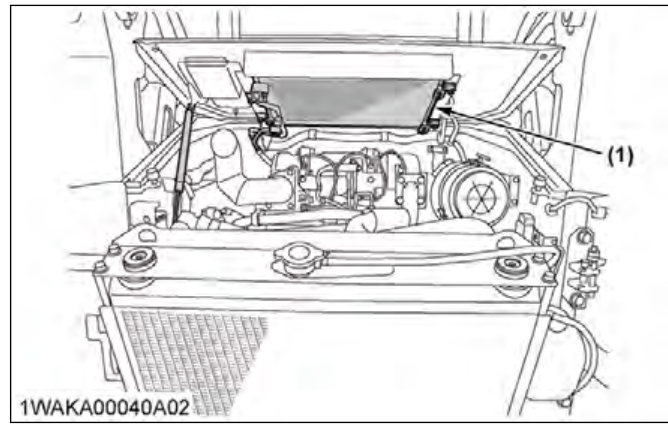
CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.

Checking

- Check the condenser and clean it if necessary.

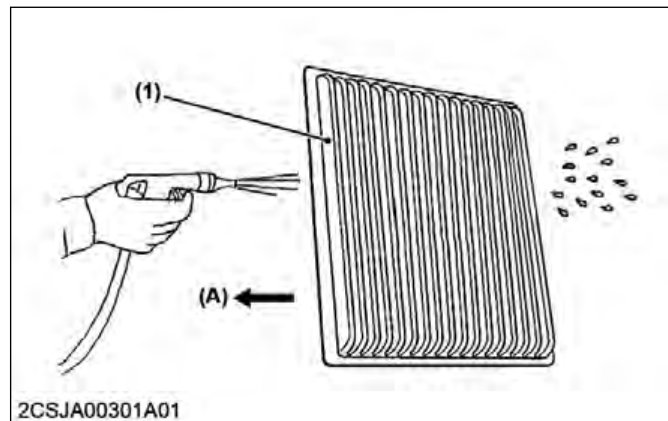


(1) Condenser

IMPORTANT

Cleaning the condenser

- Pressure of the compressed air must be under 205 kPa (2.1 kg/cm², 30 psi).



(1) Condenser

(A) Intake air flow

2.3 Adjusting the air conditioning belt

CAUTION

- Stop the engine, remove the key, and hang a DO NOT OPERATE tag near the operator's seat when checking or adjusting the fan belt.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

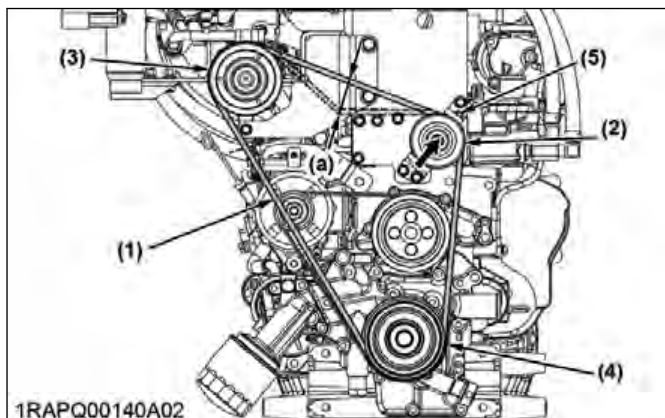
CAUTION

- Check that the rear bonnet is securely locked.

- Open the upper bonnet.
- Tilt the radiator.

Adjusting

1. Loosen the lockout and tension bolt to adjust the tension of the air conditioning belt.
2. Tighten the tension bolt and locknut.



- (1) Air conditioning belt (4) Pulley
(2) Tension pulley (5) Tension bolt
(3) Compressor

3. Push position (a) to check the tension of the air conditioning belt.

Service specification

(a) Air conditioning belt tension	7.0 to 9.0 mm 0.27 to 0.35 in.	Push with 50 to 60 N Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf
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4. Start the engine and check that the air conditioning belt does not slip.

■ IMPORTANT

- The inside of the cab may not be cooled down if running the engine with a loose belt.

3. Every 500 hours

3.1 Replacing the air conditioning belt



CAUTION

- Stop the engine, remove the key, and hang a DO NOT OPERATE tag near the operator's seat when checking, adjusting or replacing the fan belt or the air conditioning belt.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



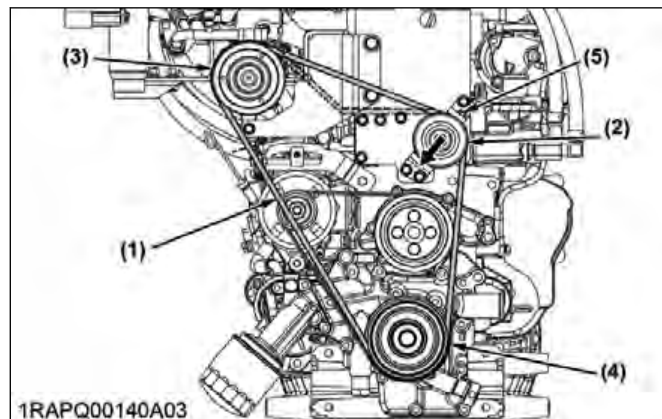
CAUTION

- Check that the rear bonnet is securely locked.

3. Open the upper bonnet.
4. Tilt the radiator.
5. Remove the fan.

Replacing

1. Loosen the lockout and tension bolt, and move the tension pulley to the direction of the wide arrow to remove the air conditioning belt.



- (1) Air conditioning belt (4) Pulley
(2) Tension pulley (5) Tension bolt
(3) Compressor

2. Replace the air conditioning belt with a new one.
3. Tighten the tension bolt and locknut.
4. Push position (a) to check the air conditioning belt tension.

Service specification

(a) Air conditioning belt tension	7.0 to 9.0 mm 0.27 to 0.35 in.	Push with 50 to 60 N Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf
-----------------------------------	-----------------------------------	--

5. Start the engine and check that the fan belt and the air conditioning belt does not slip.

■ IMPORTANT

- The warning lamp will be displayed if running the engine with a loose belt.

4. Every 1000 hours

4.1 Replacing the air filter



CAUTION

- Wear an eye protector when cleaning the air filter with compressed air.

■ IMPORTANT

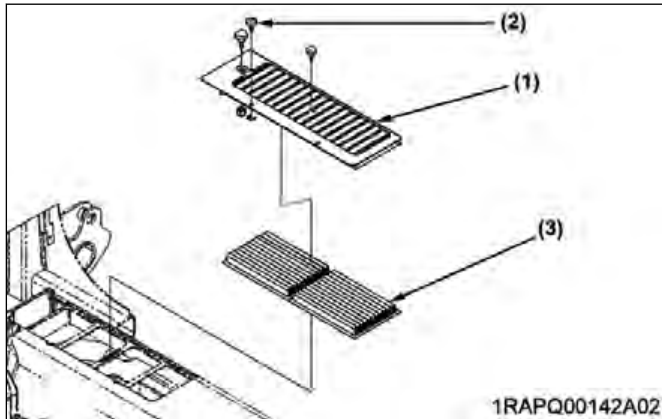
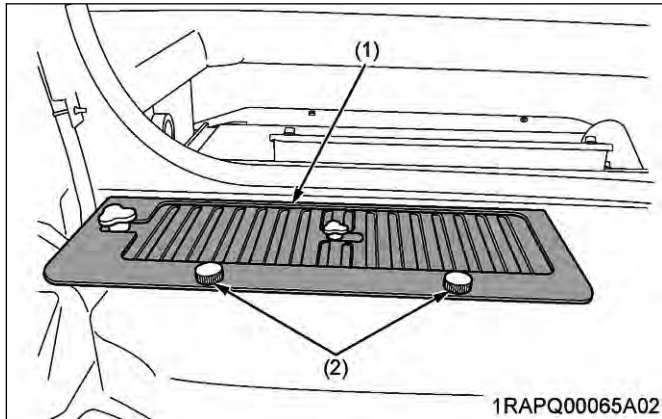
- In the case of using the machine in extremely dusty conditions, check and clean or replace the air filter more frequently.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Replacing

1. Remove the 2 screws to replace the air filter with a new one.



- (1) Cover
(2) Screw ×2
(3) Air filter

NOTE

- Do not damage the air filter to avoid dust contamination which may cause damage and malfunction of the air conditioning system.

5. Every 1 year**5.1 Checking the air conditioning and heater hoses****CAUTION**

- Wear gloves, work clothing and eye protector to protect your skin and eyes. The liquid refrigerant may cause the frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.

- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

IMPORTANT

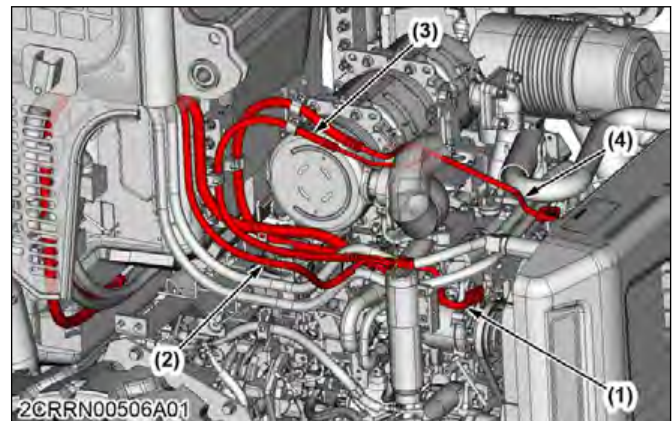
- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using parts which are not specified by R134a may cause leakage, performance decrement, and so on.
- Apply compressor oil to every O-ring to avoid damage when installing.

Preparing

1. Vacuum the refrigerant from the cooling circuit.
2. Drain the coolant.

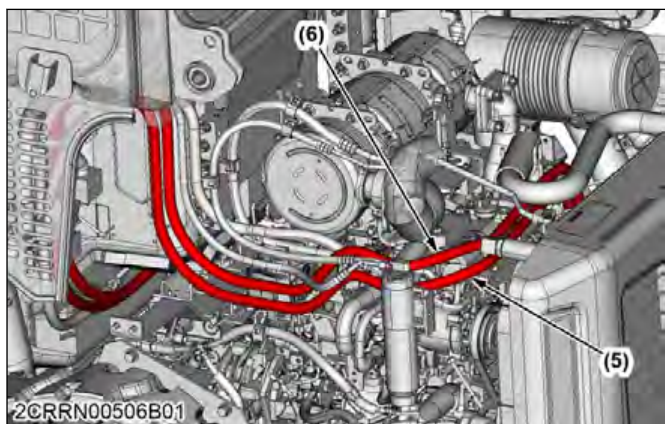
Checking the air conditioning and heater hoses

1. Check the air conditioning hoses, and replace them if necessary.



- (1) Suction hose
(2) Pressure hose
(3) Liquid hose
(4) Discharge hose

2. Check the heater pipes and hoses, and replace them if necessary.



(5) Heater hose (inlet) (6) Heater hose (outlet)

Concluding

1. Charge the cooling circuit with the refrigerant.
2. Refill the radiator with the coolant.

6. Every 2 years

6.1 Replacing the air conditioning and heater hoses

CAUTION

- Wear gloves, work clothing and eye protector to protect your skin and eyes. The liquid refrigerant may cause the frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

IMPORTANT

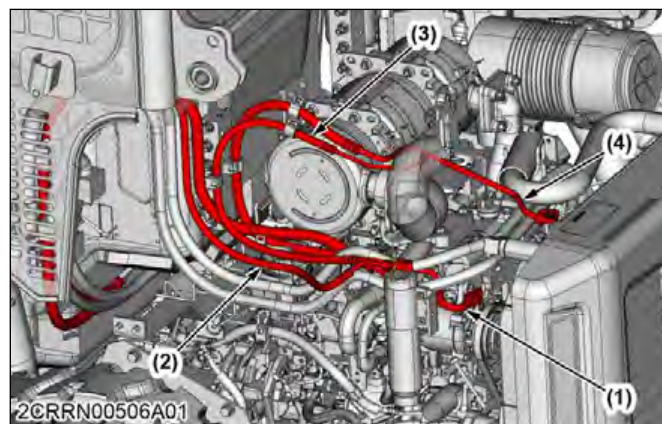
- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using parts which are not specified by R134a may cause leakage, performance decrement, and so on.
- Apply compressor oil to every O-ring to avoid damage when installing.

Preparing

1. Vacuum the refrigerant from the cooling circuit.
2. Drain the coolant.

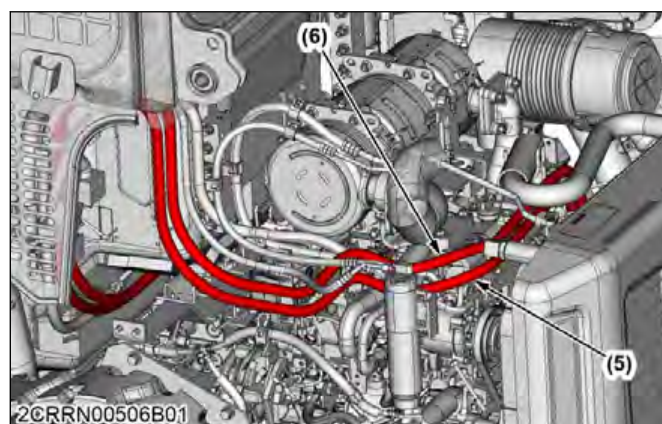
Replacing the air conditioning and heater hoses

1. Replace the air conditioning pipes and hoses with new ones.



(1) Suction hose (2) Pressure hose (3) Liquid hose (4) Discharge hose

2. Replace the heater pipes and hoses with new ones.



(5) Heater hose (inlet) (6) Heater hose (outlet)

Concluding

1. Charge the cooling circuit with the refrigerant.
2. Refill the radiator with the coolant.

7. Service as required

7.1 Checking the refrigerant

CAUTION

- Use protective gloves and goggles when removing the hose from the charging valve.

NOTE

- Always use the R134a refrigerant and the compressor oil for the R134a refrigerant.

Preparing

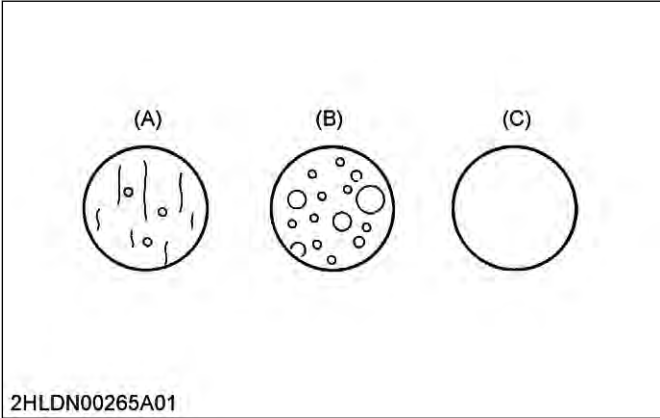
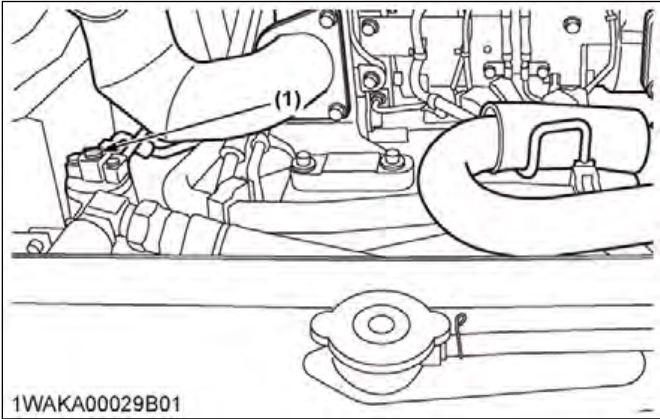
1. Lower the front attachment to the ground, and stop the engine.

Checking

1. Start the engine, and turn on the air conditioning.
2. Set the engine speed to 1500 rpm, and set an air flow of the air conditioner to the maximum.

3. MAINTENANCE

3. Check the flow of the refrigerant from the sight glass.



(1) Sight glass

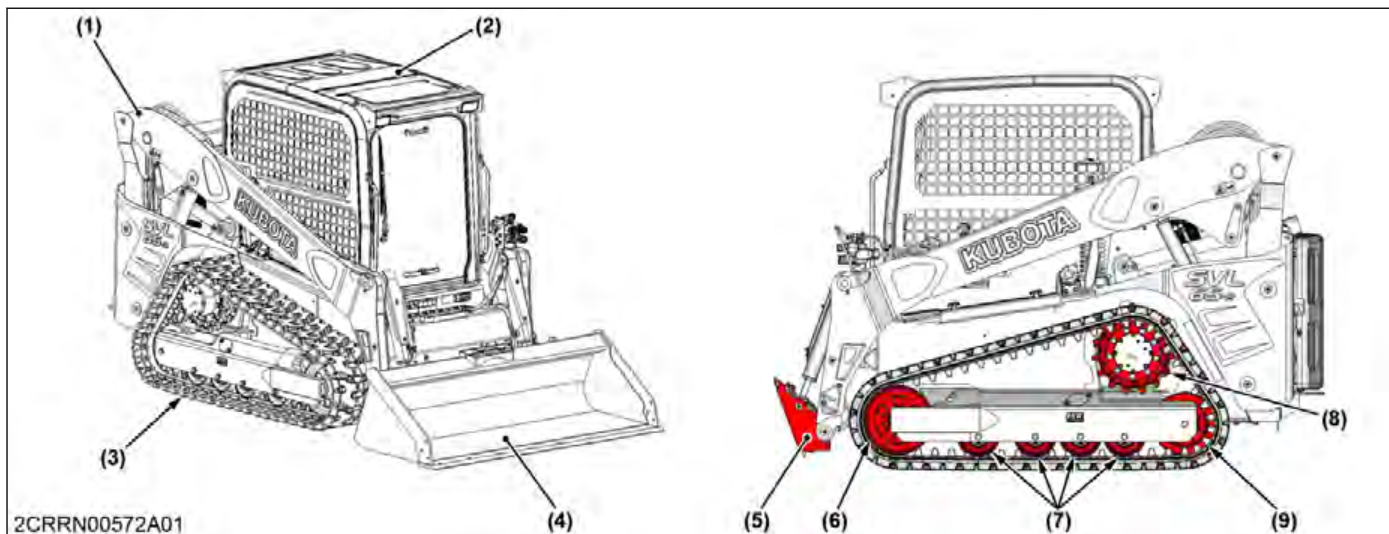
(A)	Suitable charge	Almost no air bubbles in the flow. If the engine speed is raised gradually from idle to 1500 rpm, the air bubbles disappear and the flow becomes transparent.
(B)	Undercharged	Air bubbles flow past constantly.
(C)	Overcharged	No air bubbles at all in the flow. Both high and low pressure sides are at high pressure and the cooling is ineffective.

4. If refrigerant is low, charge the refrigerant gas.

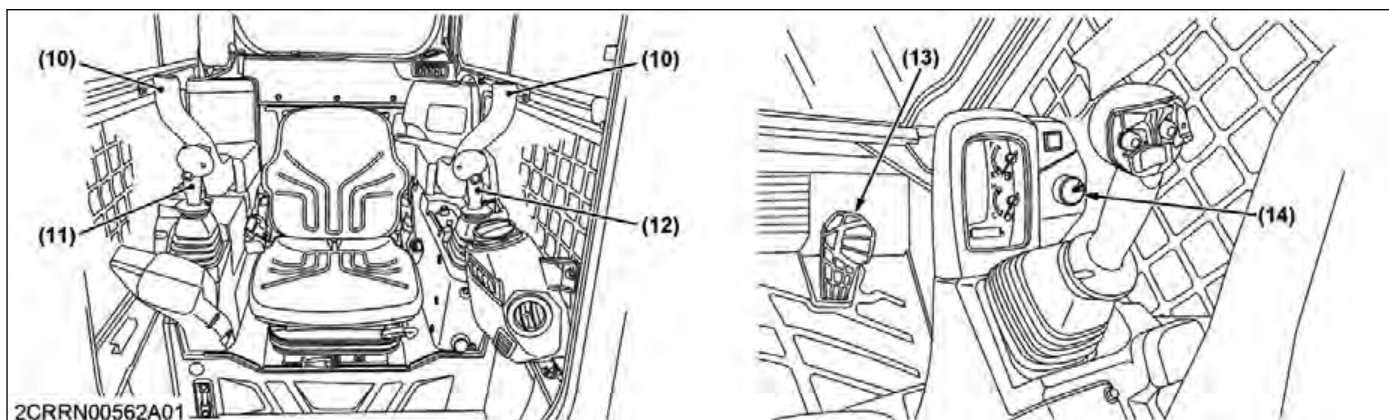
4. MACHINE BODY

MECHANISM

1. Machine device layout



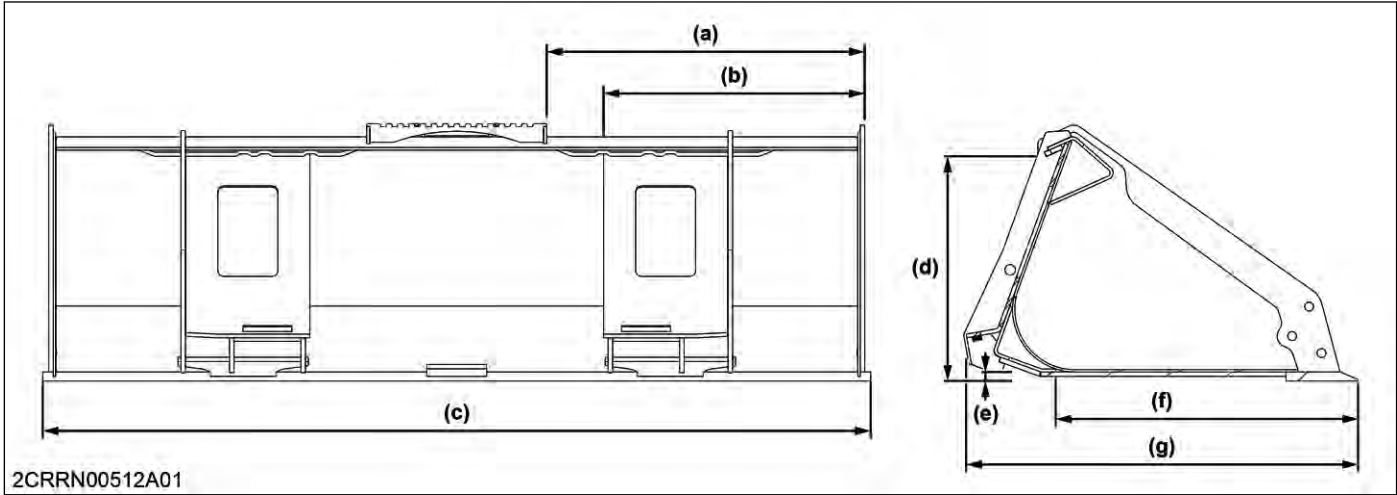
- | | | |
|------------------|-----------------|------------------|
| (1) Lift arm | (4) Bucket | (7) Track roller |
| (2) Cab | (5) Quick hitch | (8) Sprocket |
| (3) Rubber track | (6) Front idler | (9) Rear idler |



- | | | |
|-------------------------------------|---------------------------|-----------------------|
| (10) Arm rest | (12) Travel control lever | (14) Accelerator dial |
| (11) Front attachment control lever | (13) Accelerator pedal | |

2. Bucket

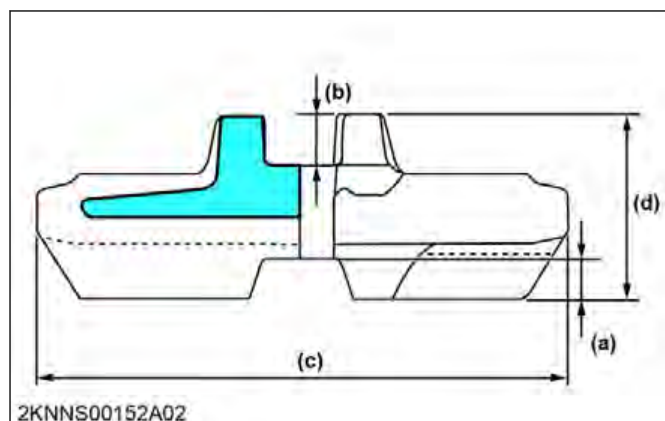
2.1 Bucket dimensions



	Dimensions	
	Standard bucket	Wide bucket
(a)	673.1 mm 26.5 in.	749.3 mm 29.5 in.
(b)	553.7 mm 21.8 in.	629.9 mm 24.8 in.
(c)	1752.6 mm 69 in.	1905 mm 75 in.
(d)	475.0 mm 18.7 in.	
(e)	19.1 mm 0.75 in.	
(f)	640.1 mm 25.2 in.	
(g)	830.6 mm 32.7 in.	

3. Rubber track

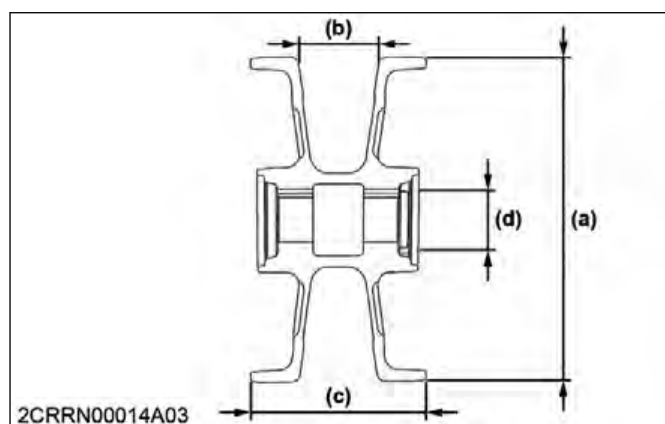
3.1 Rubber track dimensions



	Dimensions	
	Standard track	Wide track
(a) Lug height	27.5 mm 1.1 in.	
(b) Link height	48 mm 1.9 in.	
(c) Width	320 mm 12.6 in.	380 mm 15.0 in.
(d) Height	111 mm 4.4 in.	

4. Front idler

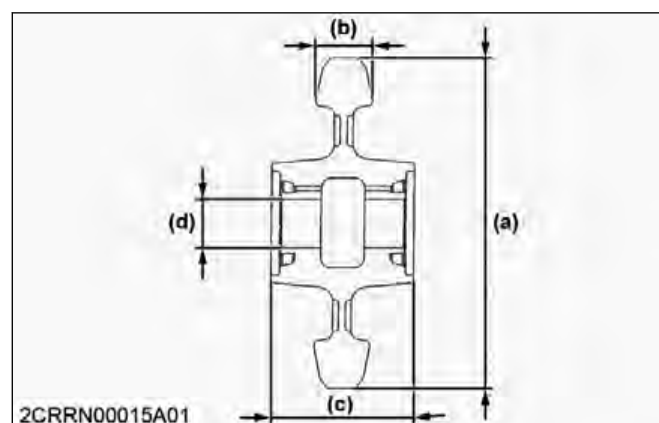
4.1 Front idler dimensions



	Dimensions
(a) Outer diameter	$\phi 356$ mm $\phi 14.0$ in.
(b) Guide Width	96 mm 3.8 in.
(c) Idler width	204 mm 8.0 in.
(d) Shaft outer diameter	$\phi 45$ mm $\phi 1.8$ in.

5. Rear idler

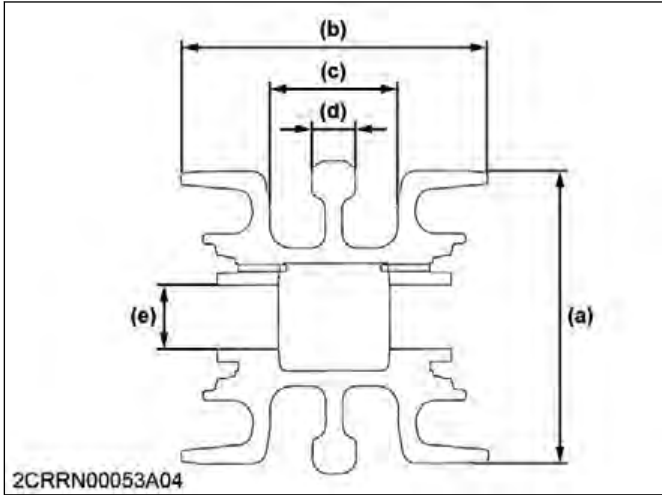
5.1 Rear idler dimensions



	Dimensions
(a) Idler outer diameter	$\phi 330$ mm $\phi 13.0$ in.
(b) Guide width	59 mm 2.3 in.
(c) Idler width	145 mm 5.7 in.
(d) Shaft outer diameter	$\phi 45$ mm $\phi 1.8$ in.

6. Track roller

6.1 Track roller dimensions

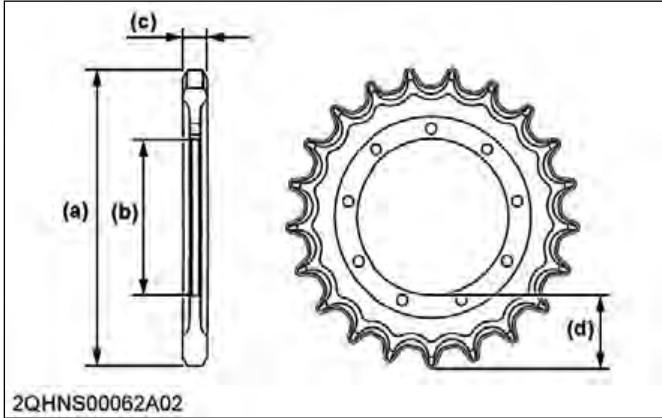


	Dimensions
(a) Outer diameter	$\phi 200$ mm $\phi 7.9$ in.
(b) Track roller width	212 mm 8.3 in.
(c) Guide width 1	88 mm 3.5 in.
(d) Guide width 2	30 mm 1.2 in.
(e) Shaft outer diameter	$\phi 40$ mm $\phi 1.6$ in.

	Dimensions
(a) Outer diameter	$\phi 429$ mm $\phi 16.9$ in.
(b) Inner diameter	$\phi 192$ mm $\phi 7.6$ in.
(c) Sprocket width	46 mm 1.8 in.
(d) Gear height	118.5 mm 4.7 in.

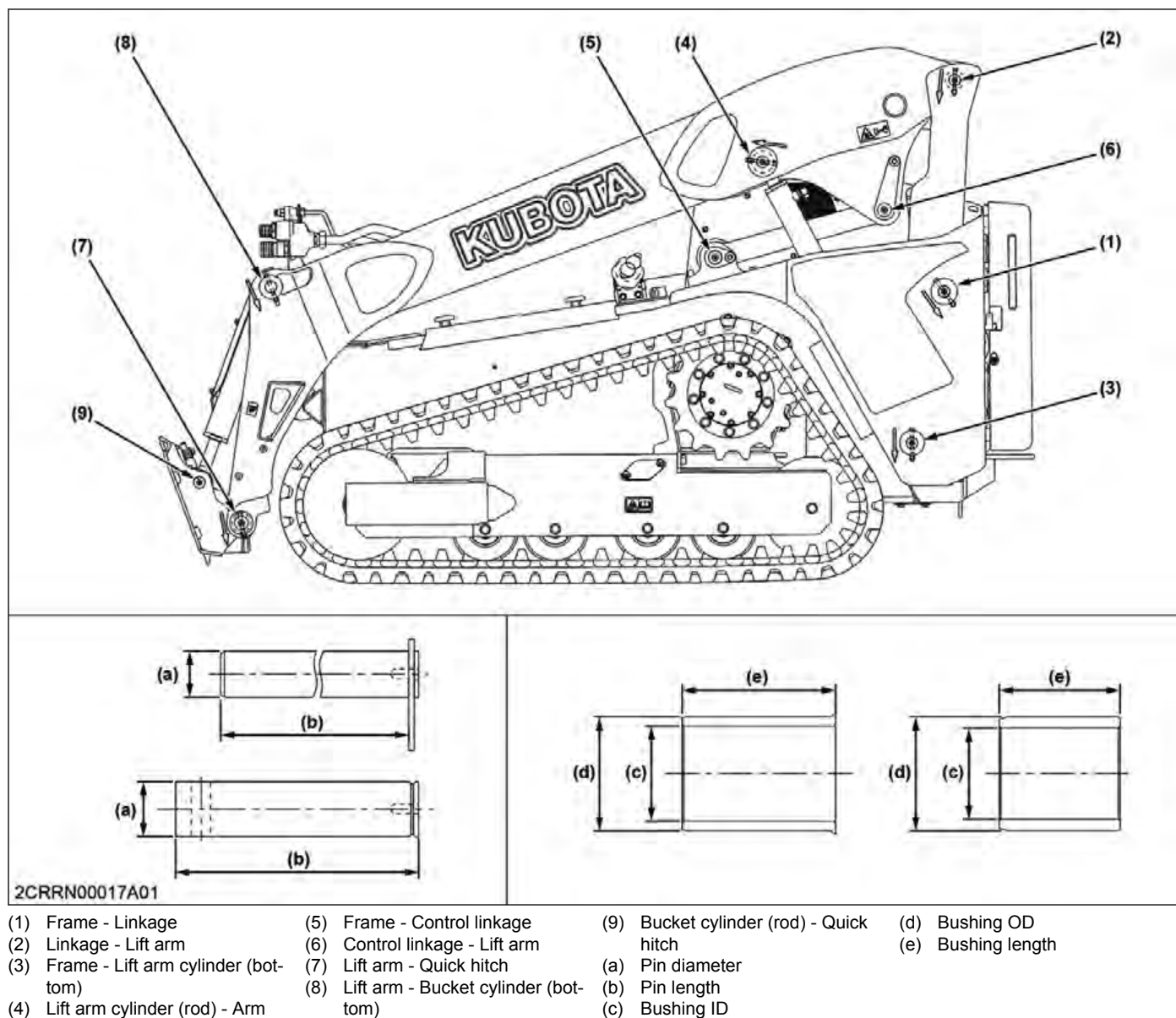
7. Sprocket

7.1 Sprocket dimensions



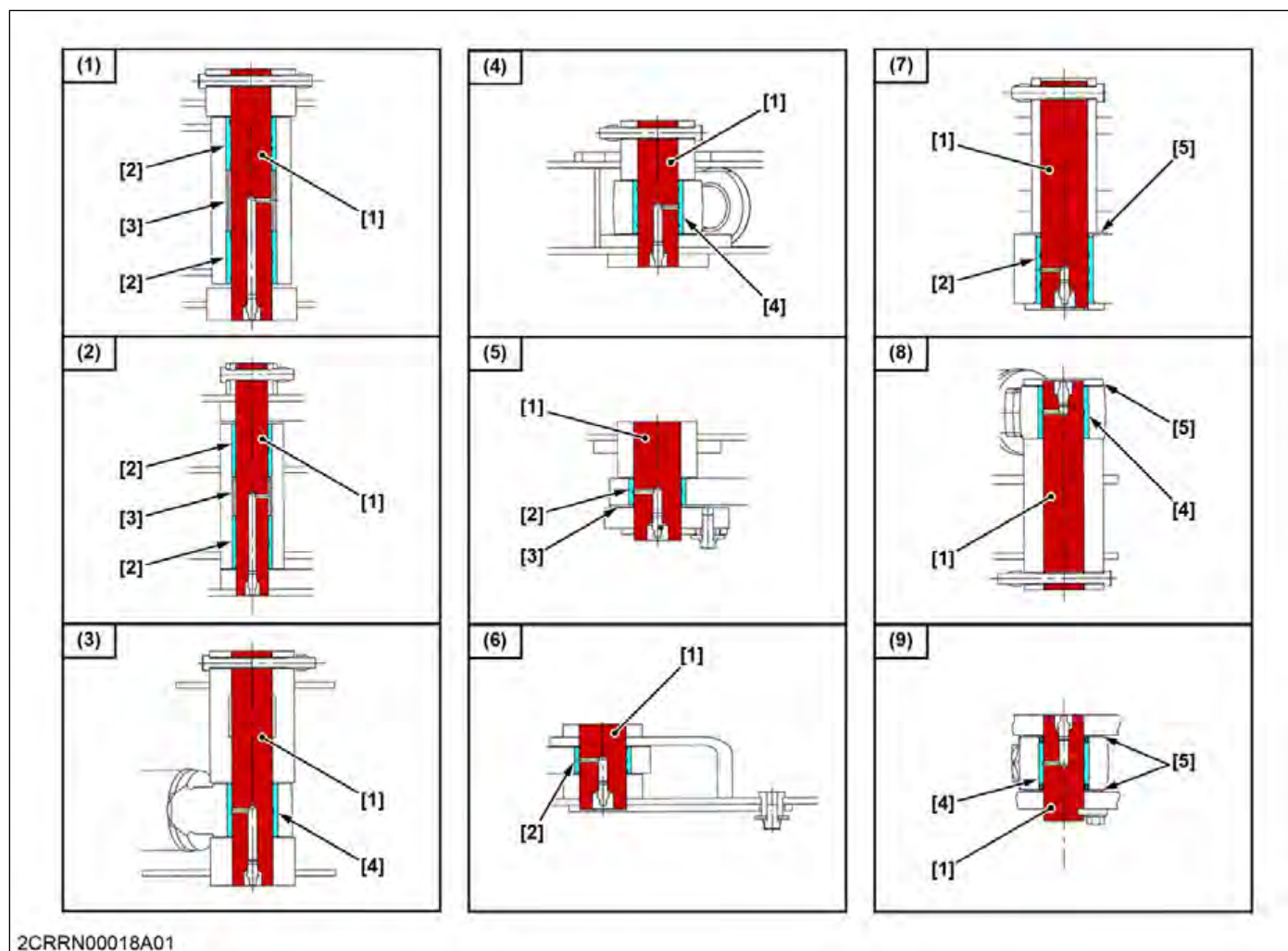
8. Pins, bushings, and shims

8.1 Pin, bushing, and shim dimensions



■ IMPORTANT

- Dimensions of bushings are based on the values when they are not assembled. Generally, bushings slightly shrink after assembly.



mm unit

	[1] Pin		[2] Bushing		[3] Collar [5] Shim	[4] Cylinder bushing
	Diameter × length	Diameter toler- ance	ID × OD × length	Bushing ID tol- erance	ID × OD × thick- ness	ID × OD × length
(1)	φ38.05 × 236.5	0 -0.03	φ38.2 × φ47.68 × 50	+0.03 -0.02	[3] φ41.8 × φ45 × 57	—
(2)	φ38.05 × 219.5	0 -0.03	φ38.2 × φ47.68 × 50	+0.03 -0.02	[3] φ41.8 × φ45 × 36	—
(3)	φ38.05 × 220.5	0 -0.03	—	—	—	φ38.2 × φ47.7 × 50
(4)	φ38.05 × 137	0 -0.03	—	—	—	φ38.2 × φ47.7 × 50
(5)	φ44.4 × 100.5	0 -0.03	φ44.55 × φ54.11 × 25	+0.03 -0.02	[3] φ46 × φ90 × 2	—
(6)	φ44.4 × 81	0 -0.03	φ44.55 × φ54.11 × 25	+0.03 -0.02	—	—

(Continued)

	[1] Pin		[2] Bushing		[3] Collar [5] Shim	[4] Cylinder bushing
	Diameter × length	Diameter toler- ance	ID × OD × length	Bushing ID tol- erance	ID × OD × thick- ness	ID × OD × length
(7)	φ44.4 × 198.5	0 -0.03	φ44.55 × φ54.11 × 63	+0.03 -0.02	[5] φ46 × φ80 × 0.5 [5] φ46 × φ80 × 1.0 [5] φ46 × φ80 × 1.5 [5] φ46 × φ80 × 2.0	—
(8)	φ38.05 × 181.5	0 -0.03	—	—	[5] φ39 × φ75 × 0.5 [5] φ39 × φ75 × 1.0 [5] φ39 × φ75 × 1.5 [5] φ39 × φ75 × 2.0	φ38.2 × φ47.7 × 50
(9)	φ38.05 × 100	0 -0.03	—	—	[5] φ39 × φ75 × 0.5 [5] φ39 × φ75 × 1.0 [5] φ39 × φ75 × 1.5 [5] φ39 × φ75 × 2.0	φ38.2 × φ47.7 × 40

inch unit

	[1] Pin		[2] Bushing		[3] Collar [5] Shim	[4] Cylinder bushing
	Diameter × length	Diameter toler- ance	ID × OD × length	Bushing ID tol- erance	ID × OD × thick- ness	ID × OD × length
(1)	φ1.498 × 9.311	0 -0.0012	φ1.504 × φ1.877 × 1.969	+0.0012 -0.0008	[3] φ1.646 × φ1.772 × 2.244	—
(2)	φ1.498 × 8.642	0 -0.0012	φ1.504 × φ1.877 × 1.969	+0.0012 -0.0008	[3] φ1.646 × φ1.772 × 1.417	—
(3)	φ1.498 × 8.681	0 -0.0012	—	—	—	φ1.504 × φ1.878 × 1.969
(4)	φ1.498 × 5.394	0 -0.0012	—	—	—	φ1.504 × φ1.878 × 1.969
(5)	φ1.748 × 3.957	0 -0.0012	φ1.754 × φ2.130 × 0.984	+0.0012 -0.0008	[3] φ1.811 × φ3.543 × 0.079	—
(6)	φ1.748 × 2.992	0 -0.0012	φ1.754 × φ2.130 × 0.984	+0.0012 -0.0008	—	—
(7)	φ1.748 × 7.815	0 -0.0012	φ1.754 × φ2.130 × 2.480	+0.0012 -0.0008	[5] φ1.811 × φ3.150 × 0.0197 [5] φ1.811 × φ3.150 × 0.0394 [5] φ1.811 × φ3.150 × 0.0591 [5] φ1.811 × φ3.150 × 0.0787	—

(Continued)

	[1] Pin		[2] Bushing		[3] Collar [5] Shim	[4] Cylinder bushing
	Diameter × length	Diameter toler- ance	ID × OD × length	Bushing ID tol- erance	ID × OD × thick- ness	ID × OD × length
(8)	$\phi 1.498 \times 7.146$	$\begin{matrix} 0 \\ -0.0012 \end{matrix}$	—	—	$\begin{matrix} [5] \phi 1.535 \times \\ \phi 2.953 \times 0.0197 \\ [5] \phi 1.535 \times \\ \phi 2.953 \times 0.0394 \\ [5] \phi 1.535 \times \\ \phi 2.953 \times 0.0591 \\ [5] \phi 1.535 \times \\ \phi 2.953 \times 0.0787 \end{matrix}$	$\phi 1.504 \times \phi 1.878$ $\times 1.969$
(9)	$\phi 1.498 \times 3.937$	$\begin{matrix} 0 \\ -0.0012 \end{matrix}$	—	—	$\begin{matrix} [5] \phi 1.535 \times \\ \phi 2.953 \times 0.0197 \\ [5] \phi 1.535 \times \\ \phi 2.953 \times 0.0394 \\ [5] \phi 1.535 \times \\ \phi 2.953 \times 0.0591 \\ [5] \phi 1.535 \times \\ \phi 2.953 \times 0.0787 \end{matrix}$	$\phi 1.504 \times \phi 1.878$ $\times 1.575$

SERVICING

1. Service specifications

1.1 Service specifications for machine body

				Units	Service specifications		Service limits
					Value	Tolerance	Value
Wear	Pin			—	—	—	1 mm of wear on the pin outer diameter
	Bushing			—	—	—	1 mm of wear on the bushing inner diameter
Dimension	Rubber track	Lug height		mm in.	27.5 1.1	—	—
		Link height		mm in.	48 1.9	—	—
		Width	Standard	mm in.	320 12.6	—	—
			Wide	mm in.	380 15.0	—	—
		Height		mm in.	111 4.4	—	—
		Tension dimension		mm in.	25 1.0	±5 ±0.2	—
	Front idler	Outer diameter		mm in.	φ356 φ14.0	—	φ348 φ13.7
		Guide width		mm in.	96 3.8	—	104 4.1
		Idler width		mm in.	204 8.0	—	—
	Rear idler	Idler outer diameter		mm in.	φ330 φ13.0	—	φ320 φ12.6
		Guide width		mm in.	59 2.3	—	49 1.9
		Idler width		mm in.	145 5.7	—	—
	Sprocket	Outer diameter		mm in.	φ429 φ16.9	—	φ417 φ16.4
		Inner diameter		mm in.	φ192 φ7.6	—	—
		Sprocket width		mm in.	46 1.8	—	34 1.3
		Gear height		mm in.	118.5 4.7	—	112.5 4.4

(Continued)

			Units	Service specifications		Service limits
				Value	Tolerance	Value
Dimension	Track roller	Outer diameter	mm in.	φ200 φ7.9	—	φ192 φ7.9
		Track roller width	mm in.	212 8.3	—	—
		Guide width 1	mm in.	88 3.5	—	96 3.8
		Guide width 2	mm in.	30 1.2	—	—

2. Testing

2.1 Measuring the operating force of the levers and pedal

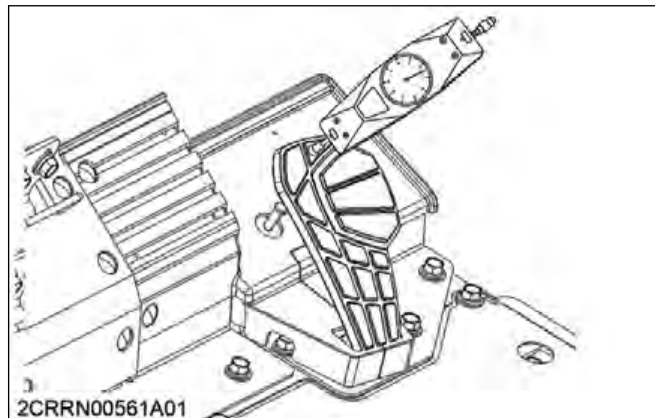
Measure the operating force of the levers and pedal to check the wear or fixation of their internal parts.

CAUTION

- Make sure that the armrests are raised before the measurement.

Measuring

1. Start the engine and accelerate to the maximum speed.
2. Set an operating force measuring device to the levers or pedal.
 - Levers: At 20 mm (0.8 in.) below the top of the lever
 - Pedal: At the pedal edge.



3. Operate the levers or the pedal and measure the force right before the levers or pedal reach the end.
4. Measure 3 times to calculate the average.



Service specifications

		Operating force
Front attachment control lever	Forward	16 to 26 N 1.7 to 2.6 kgf 3.6 to 5.8 lbf
	Backward	15 to 25 N 1.6 to 2.5 kgf 3.4 to 5.6 lbf
	LH	12 to 22 N 1.3 to 2.2 kgf 2.7 to 4.9 lbf
	RH	11 to 21 N 1.2 to 2.1 kgf 2.5 to 4.7 lbf
Travel control lever	Forward	11 to 21 N 1.1 to 2.1 kgf 2.5 to 4.7 lbf
	Backward	14 to 24 N 1.5 to 2.4 kgf 3.2 to 5.3 lbf
	LH	10 to 20 N 1.1 to 2.0 kgf 2.3 to 4.4 lbf
	RH	10 to 20 N 1.0 to 2.0 kgf 2.3 to 4.4 lbf
Accelerator pedal		40 to 60 N 4.1 to 6.1 kgf 9.0 to 13 lbf

3. Repairing

3.1 Lift arm

3.1.1 Removing and installing the lift arm



CAUTION

- When removing or installing the lift arm, work with 2 or more persons.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.
- Do not put your finger into the pinholes.

IMPORTANT

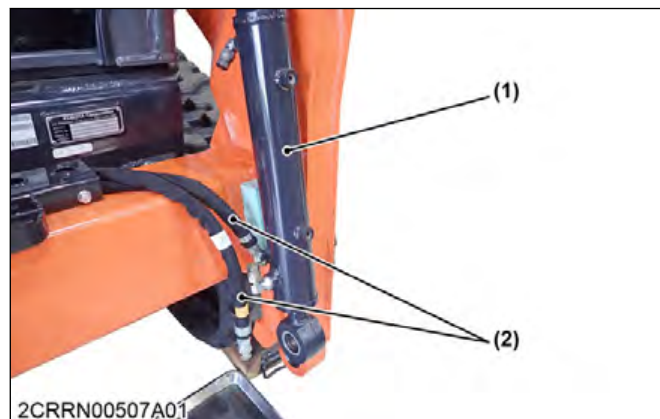
- Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground, lower the front attachment to the ground, and stop the engine.
2. Remove the cab.
3. Remove the quick hitch.

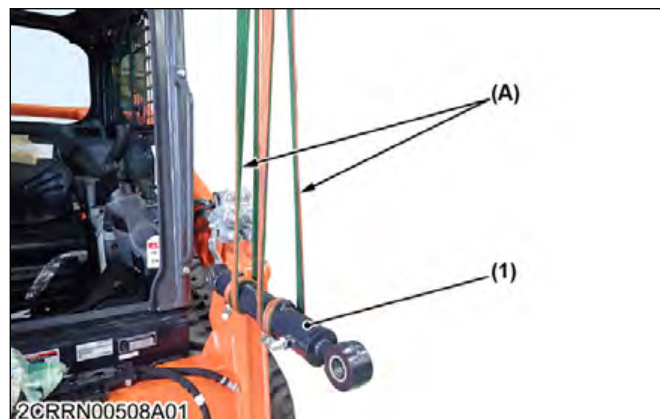
Removing

1. Remove the 2 hydraulic hoses from the bucket cylinder.



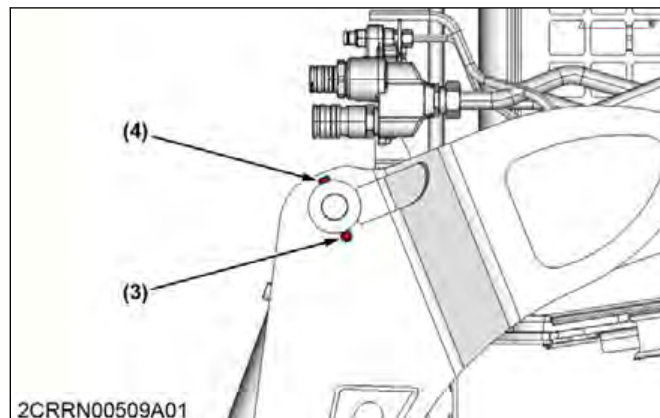
- (1) Bucket cylinder (2) Hydraulic hose ×2

2. Attach 2 nylon slings to the bucket cylinder, and hoist for support.



- (1) Bucket cylinder (A) Nylon sling ×2

3. Remove the bolt and self-locking nut.



- (3) Self-locking nut (M10) (4) Bolt (M10 × 100)

4. Remove the pin with a hammer, and remove the bucket cylinder.

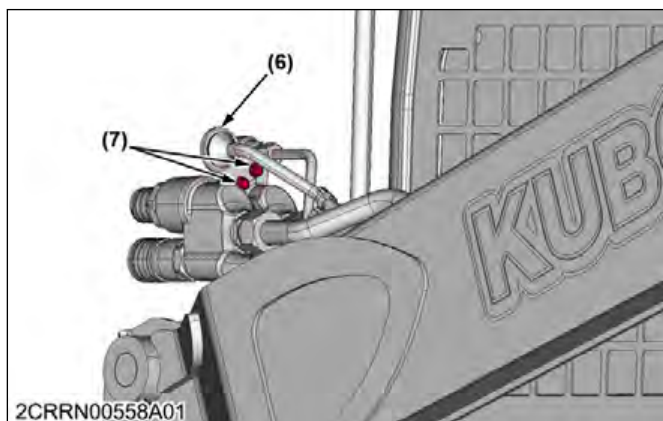


(5) Pin

Mass

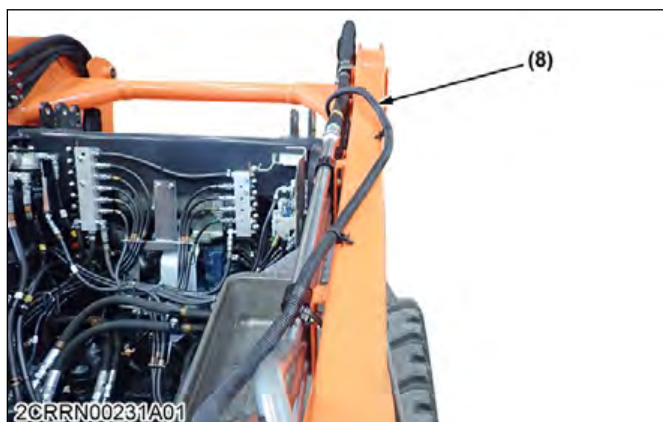
(1) Bucket cylinder	Approximately 16 kg Approximately 35 lbs
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5. Remove the other bucket cylinder with the same procedure.
6. Remove the 2 bolts to remove the electrical AUX outlet from the AUX outlet block.



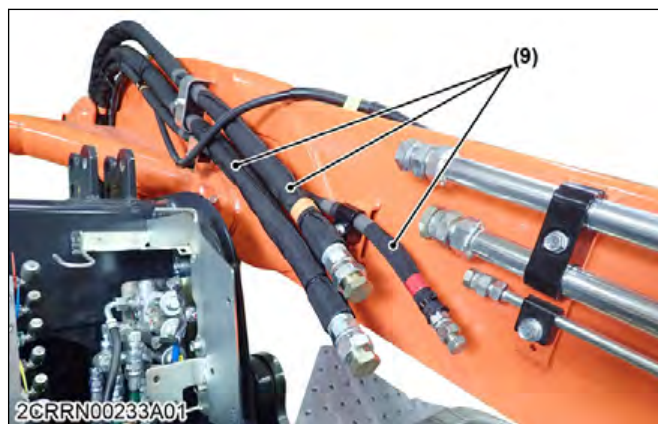
(6) Electrical AUX outlet (7) Bolt (M8 × 20) × 2

7. Remove the wire harness from the lift arm.



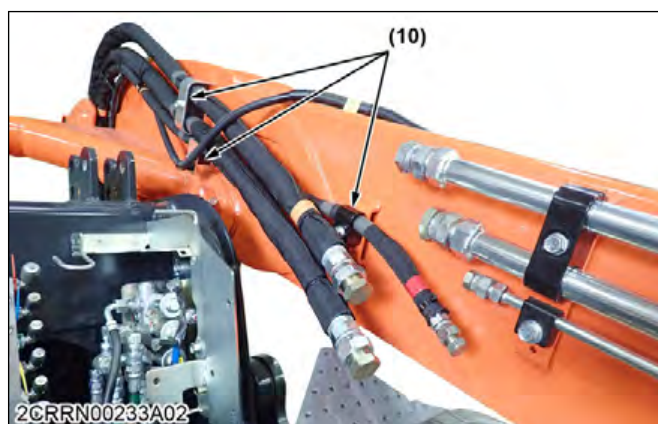
(8) Wire harness

8. Disconnect the 3 hydraulic hoses from the pipes.



(9) Hydraulic hose × 3

9. Remove the 3 clamps to remove the 3 hydraulic hoses from the lift arm.



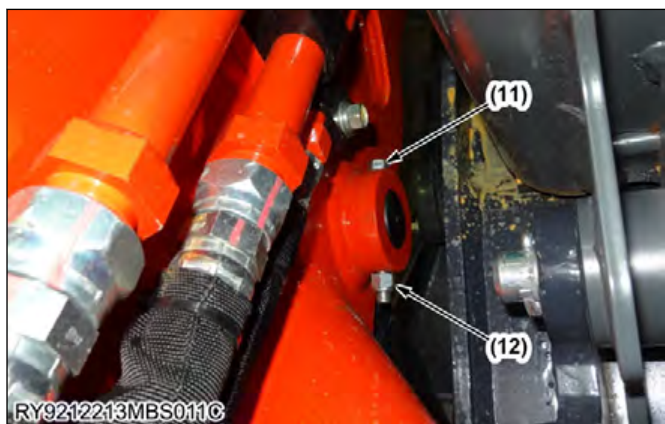
(10) Clamp × 3

10. Remove the hydraulic hoses from the lift arm on the opposite side with the same procedure.
11. Attach 4 nylon slings to the lift arm, and hoist for support.



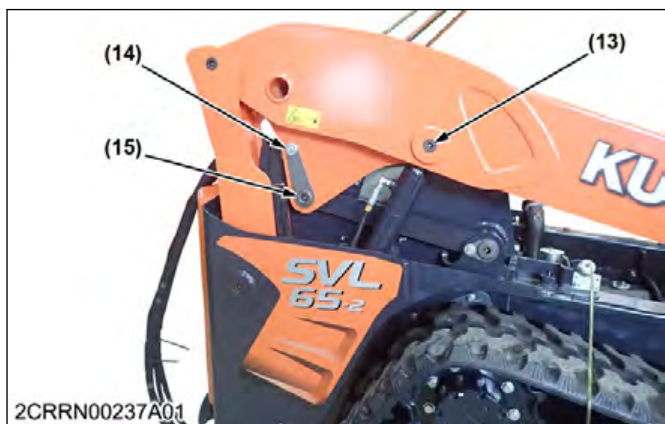
(A) Nylon sling × 4

12. Remove the self-locking nuts and bolts on the rod side of the lift arm cylinder on both sides.



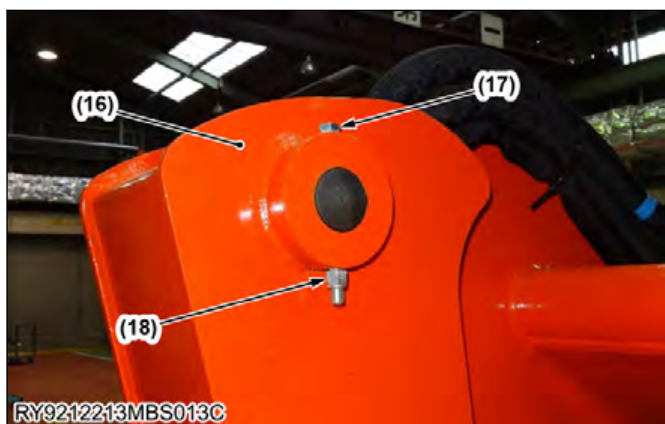
(11) Bolt (M10 × 90) (12) Self-locking nut (M10)

13. Remove the bolt and 2 pins on both sides.



(13) Pin (15) Pin
(14) Bolt (M10 × 16)

14. Remove the self-locking nuts and bolts on the lift arm links on both sides.



(16) Lift arm link (18) Self-locking nut (M10)
(17) Bolt (M10 × 80)

15. Hoist the lift arm and remove the 2 pins of the lift arm link with a hammer.



(19) Pin × 2

16. Remove the lift arm.



(20) Lift arm

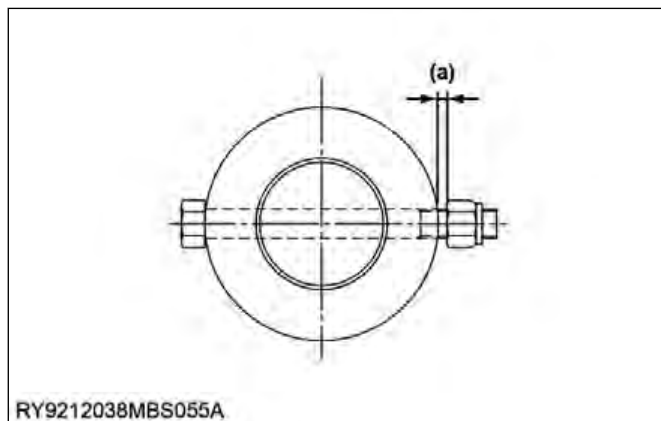
Mass

(20) Lift arm	Approximately 371 kg Approximately 818 lbs
---------------	---

Installing

NOTE

- When installing the self-locking nuts, make sure that there is a gap between the nut and boss.



(a) Gap (1.0 to 3.0 mm, 0.04 to 0.12 in.)

3.2 Cab

3.2.1 Removing and installing the cab

CAUTION

- Do not work soon after the engine has stopped.
 - The heater hose is extremely hot.

Preparing

- Park the machine on the firm and level ground, lower the front attachment to the ground, and stop the engine.
- Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
- Drain the coolant.

■ NOTE

- Closed cab specification only.

- Vacuum the refrigerant from the cooling circuit.

■ NOTE

- Closed cab specification only.

- Tilt up the cab.

Removing

- Remove the cooler hoses and heater hoses from the cab.

■ NOTE

- Closed cab specification only.



(1) Cooler hose ×2

(2) Heater hose ×2

- Remove the cooler hoses and heater hoses from the clamp.



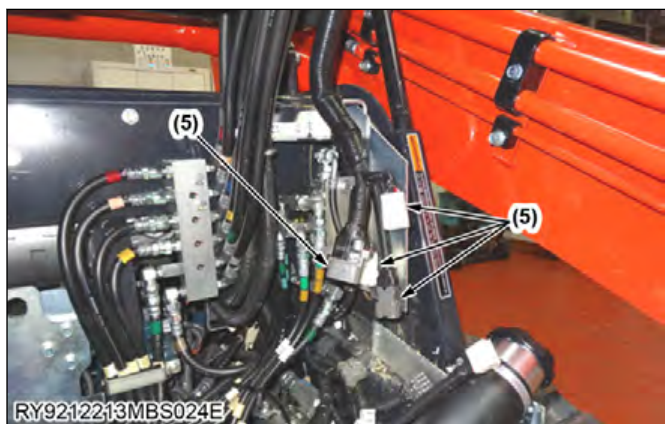
(3) Clamp

- Disconnect the 12 hydraulic quick connectors from the block relays.



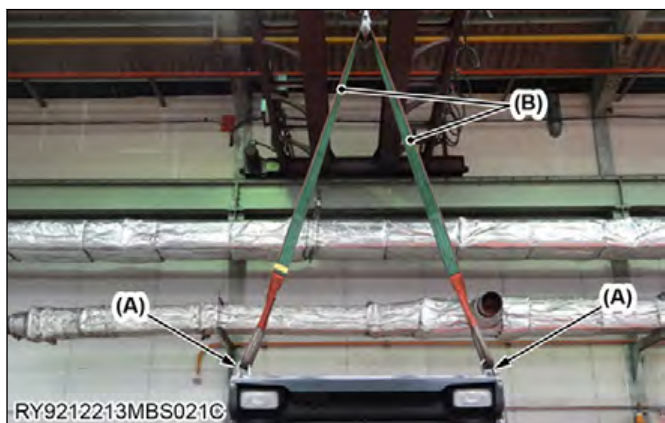
(4) Hydraulic quick connector
×12

- Disconnect the 4 joint connectors.



(5) Joint connector ×4

5. Remove the cab lock pin and lower the cab. Attach 2 shackles and 2 nylon slings on the front side of the cab, and hoist for support.



(A) Shackle ×2

(B) Nylon sling ×2

6. Tilt up the cab and install the cab lock pin. Remove the split pin from the damper to remove the dampers on both sides.



(7)

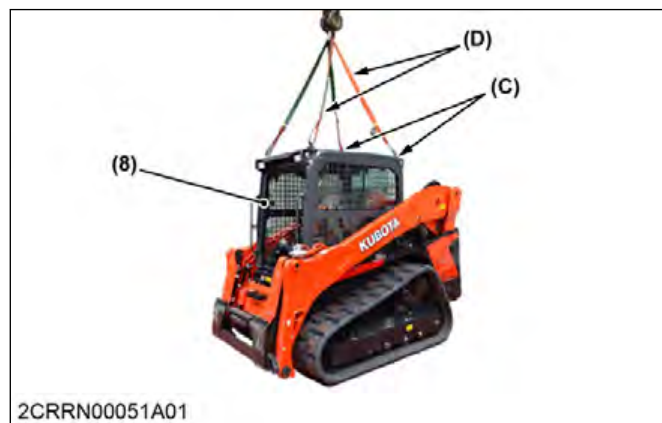
(6)



(6) Split pin

(7) Damper

7. Remove the cab lock pin and gently tilt down the cab with a crane.
8. Attach 2 nylon slings and 2 shackles on the rear side of the cab and hoist for support.



(8) Cab

(C) Shackle ×2

(D) Nylon sling ×2

9. Remove the 2 pins.

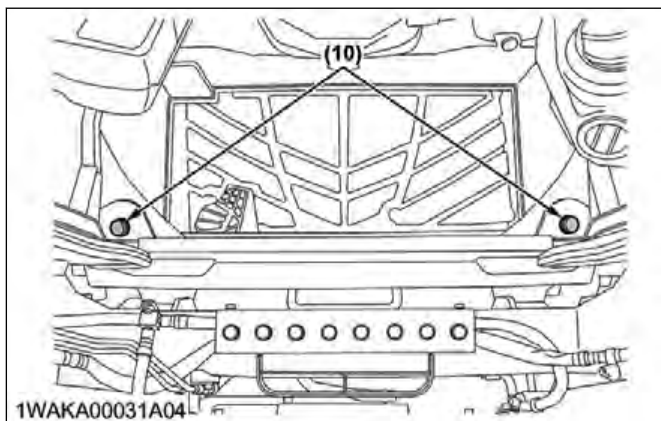


(9) Pin ×2

10. Remove the cab.

**Mass**

(8) Cab	Approximately 312 kg Approximately 688 lbs
---------	---

Installing

(10) Bolt (M16 × 75) ×2

Tightening torque

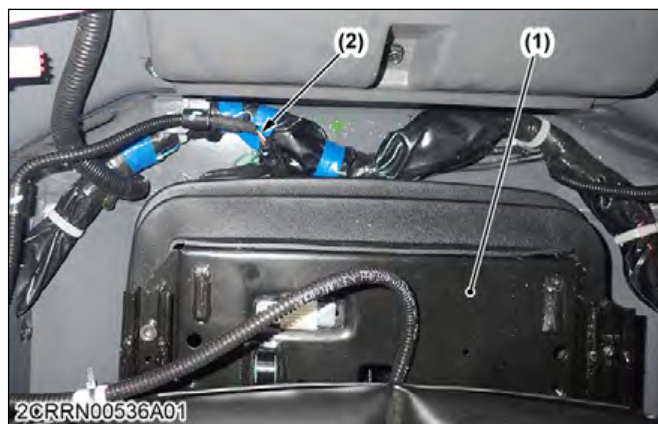
(10) Bolt	77.5 to 90.2 N · m 7.9 to 9.2 kgf · m 51.8 to 66.5 lbf · ft	—
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3.3 Seat**3.3.1 Removing and installing the seat****Preparing**

1. Park the machine on the firm and level ground, lower the front attachment to the ground, and stop the engine.

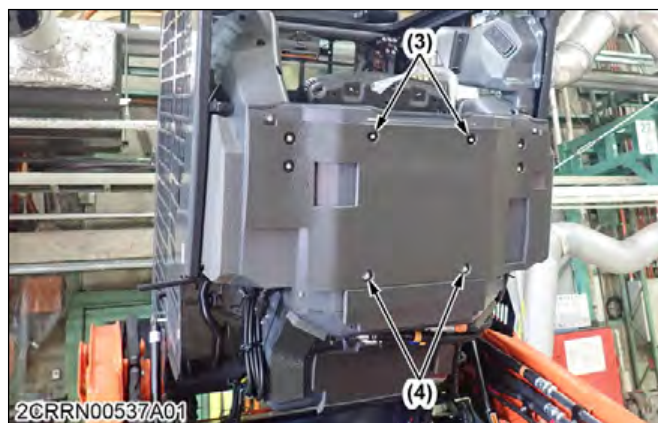
Removing

1. Tilt the backrest of the seat forward and slide the seat forward.
2. Disconnect the OPC connector.



(1) Seat (2) OPC connector

3. Tilt up the cab until the latch engages. Install the lock pin to lock the cab.
4. Remove the 2 flange nuts and 2 bolts.



(3) Flange nut ×2 (4) Bolt (M8 × 20) ×2

5. Remove the cab lock pin. Lower the cab, and remove the seat.

Mass

(1) Seat	Approximately 32 kg Approximately 71 lbs
----------	---

Installing

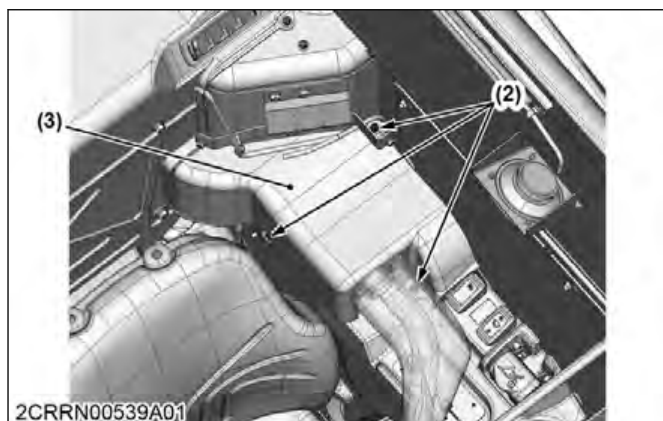
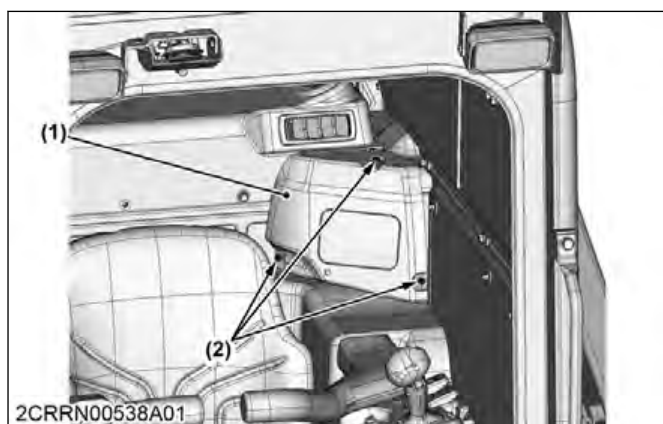
(3) Flange nut	23.5 to 27.5 N · m 2.4 to 2.8 kgf · m 17.3 to 20.2 lbf · ft	—
(4) Bolt	23.5 to 27.5 N · m 2.4 to 2.8 kgf · m 17.3 to 20.2 lbf · ft	—

3.4 Armrest**3.4.1 Removing the armrests****Preparing**

1. Park the machine on the firm and level ground, lower the front attachment to the ground, and stop the engine.

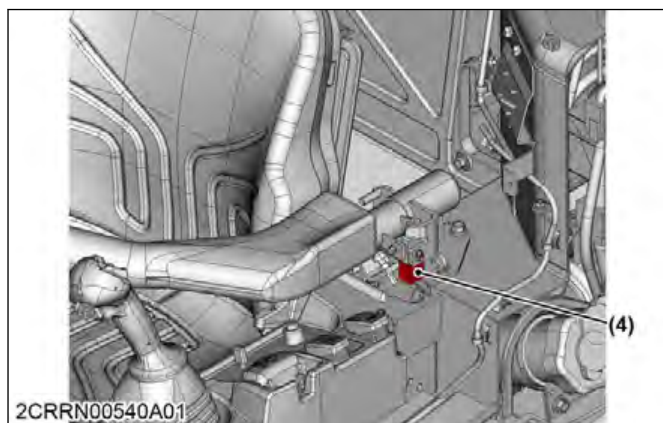
Removing the armrest LH

1. Remove the 6 bolts and 2 covers.



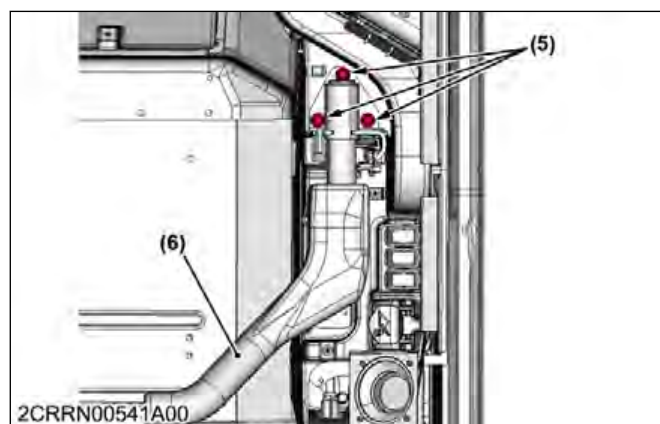
- (1) Cover
(2) Bolt (M6 × 16) × 6
(3) Cover

2. Disconnect the armrest switch connector LH.



- (4) Armrest switch connector LH

3. Remove the 3 bolts to remove the armrest LH.



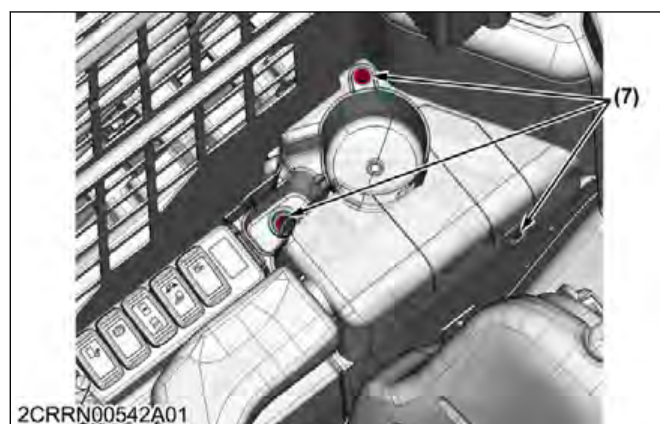
- (5) Bolt (M10 × 25) × 3
(6) Armrest LH

Mass

(6) Armrest LH	Approximately 3.5 kg Approximately 7.8 lbs
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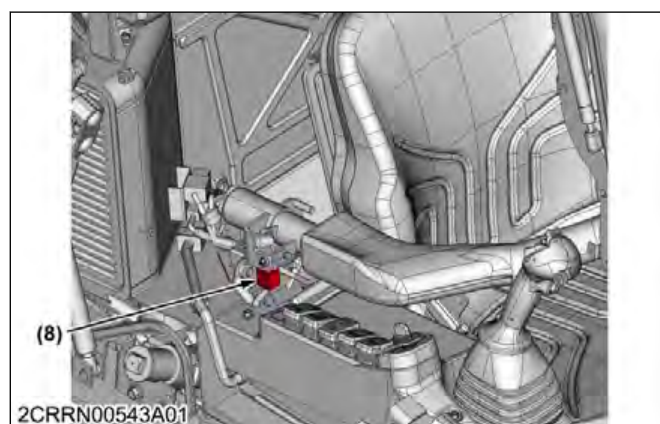
Removing the armrest RH

1. Remove the 3 bolts and cover.



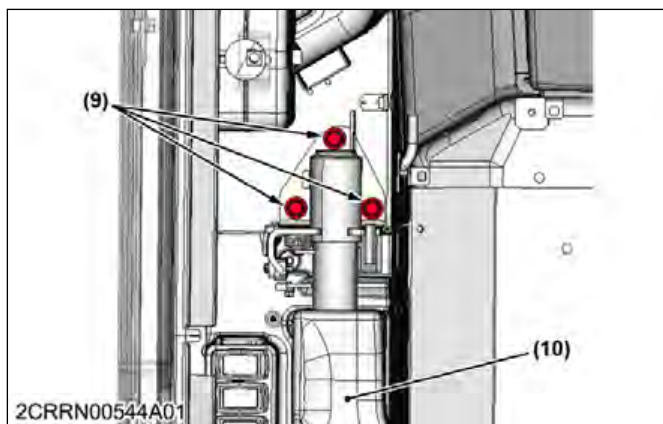
- (7) Bolt (M6 × 16) × 3

2. Disconnect the armrest switch connector RH.



- (8) Armrest switch connector
RH

3. Remove the 3 bolts and armrest RH.



(9) Bolt (M10 × 25) × 3

(10) Armrest RH

Mass

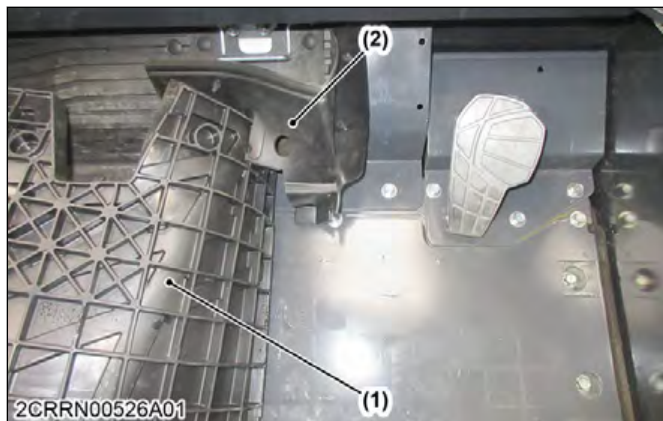
(10) Armrest RH	Approximately 3.5 kg Approximately 7.8 lbs
-----------------	---

3.5 Accelerator pedal**3.5.1 Removing the accelerator pedal****Preparing**

1. Park the machine on the firm and level ground, lower the front attachment to the ground, and stop the engine.

Removing

1. Remove the 2 rubber mats.



(1) Rubber mat 1

(2) Rubber mat 2

2. Remove the snap pin and pin.



(3) Snap pin

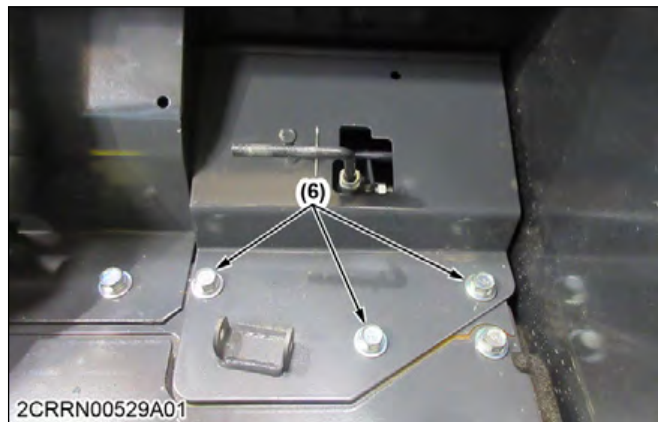
(4) Pin

3. Remove the accelerator pedal.



(5) Accelerator pedal

4. Remove the 3 bolts.



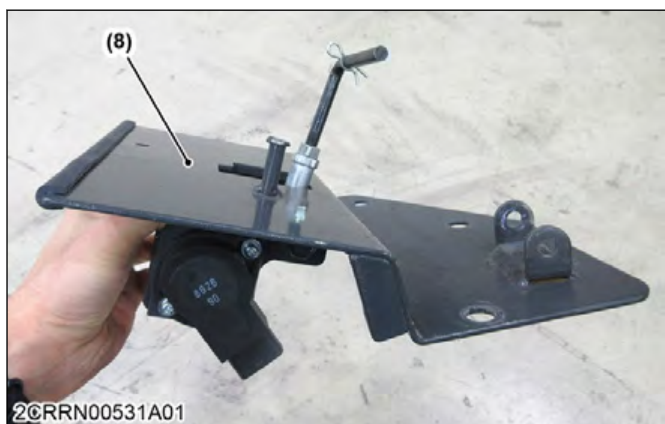
(6) Bolt (M10 × 20) × 3

5. Disconnect the accelerator pedal sensor connector.



(7) Accelerator pedal sensor connector

6. Remove the bracket assembly.



(8) Bracket assembly

3.6 Rubber track

3.6.1 Removing and installing the rubber track



CAUTION

- Place the machine on the jack stands securely when lifting the machine.
- Do not work underneath when the machine is jacked up.
- Keep hands and body away from the rotating track.
- To avoid a direct, high-pressure release of the grease,
 - Do not stand in front of the grease fitting.
 - Loosen the grease fitting slowly.

IMPORTANT

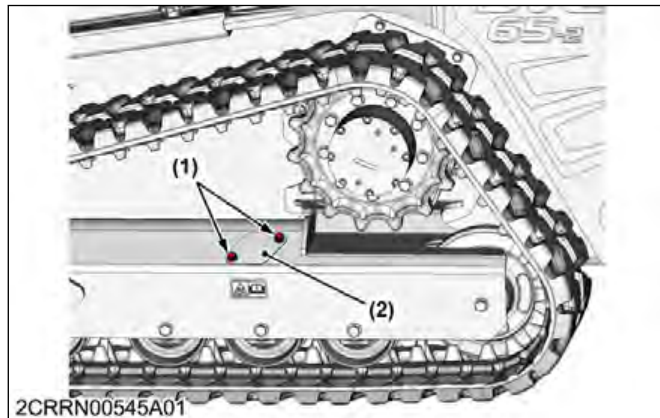
- Be sure to install the rubber track in the correct direction.

Preparing

1. Lower the front attachment to the ground, and stop the engine.

Removing

1. Remove the 2 bolts to remove the cover.



(1) Bolt (M12 × 30) ×2

(2) Cover

2. Loosen the grease fitting slowly.



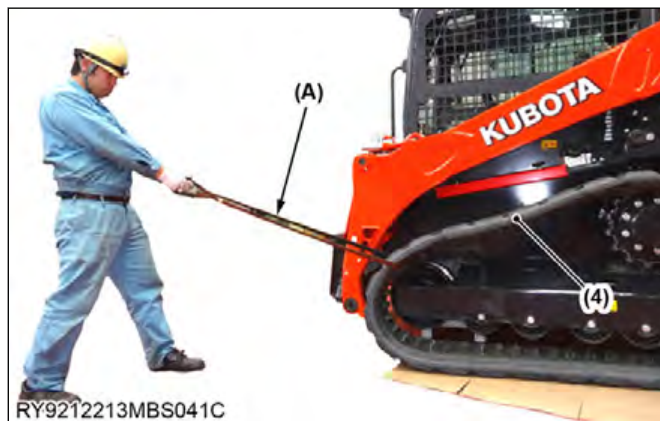
(3) Grease fitting

3. Jack up the machine.

4. Attach a nylon sling to the front side of the rubber track. Slide the rubber track to remove it from the front idler.

NOTE

- Put cardboard under the rubber track so that the rubber track can slide easily.



(4) Rubber track

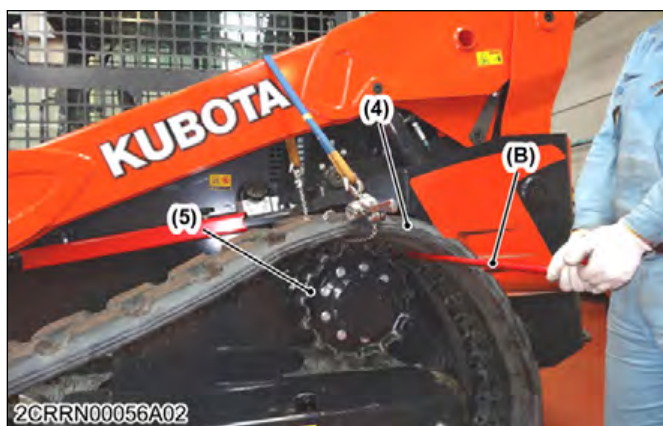
(A) Nylon sling

5. Attach a nylon sling to the rubber track, and hoist for support.



(4) Rubber track (A) Nylon sling

6. Remove the rubber track from the sprocket with a crowbar.



(4) Rubber track (B) Crowbar
(5) Sprocket

7. Remove the rubber track.



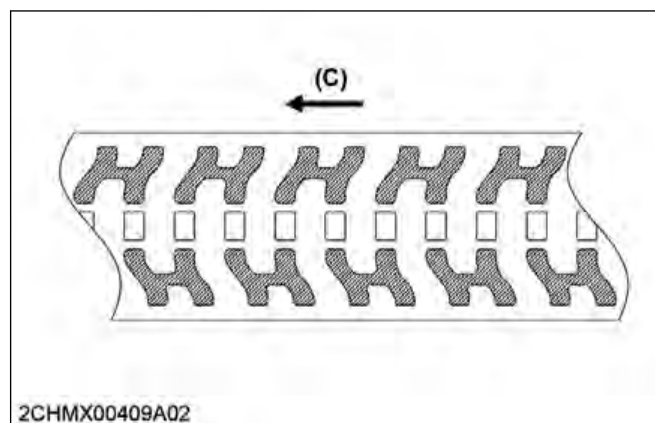
Mass

(4) Rubber track	Standard track	Approximately 161 kg Approximately 355 lbs
	Wide track	Approximately 176 kg Approximately 388 lbs

Installing

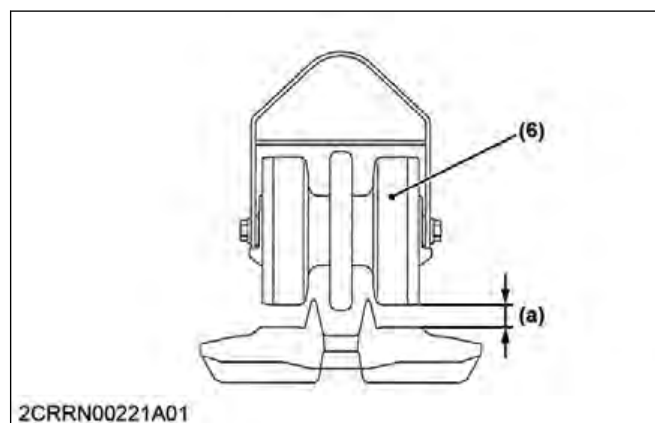
■ IMPORTANT

- Install the rubber track in the correct direction.



(C) Front side of the machine

- Adjust the distance between the rubber track and the second track roller.



(6) Second track roller

(a) 20 to 30 mm (0.8 to 1.2 in.)

3.7 Front idler

3.7.1 Removing and installing the front idler



WARNING

- Place the machine on the jack stands securely when lifting the machine.
- Do not work underneath when the machine is jacked up.

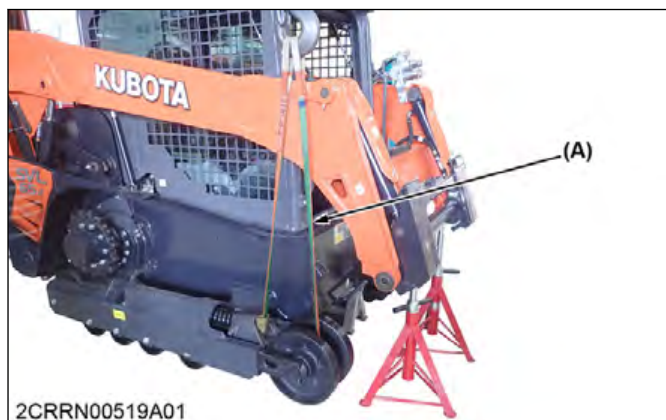
- Keep hands and body away from the rotating track.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Jack up the machine.
3. Remove the rubber track.

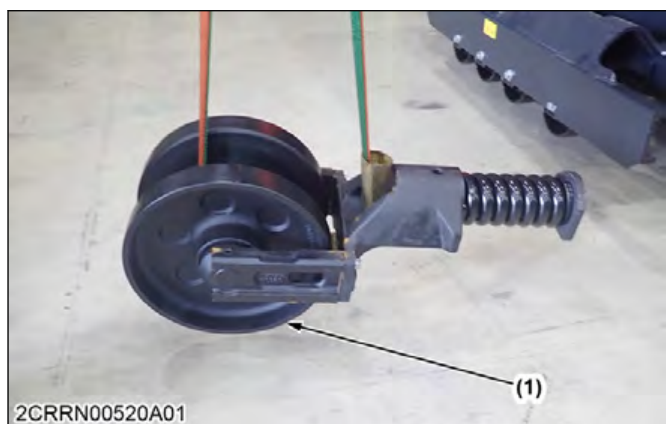
Removing

1. Attach a nylon sling to the front idler, and hoist for support.



(A) Nylon sling

2. Remove the front idler assembly.

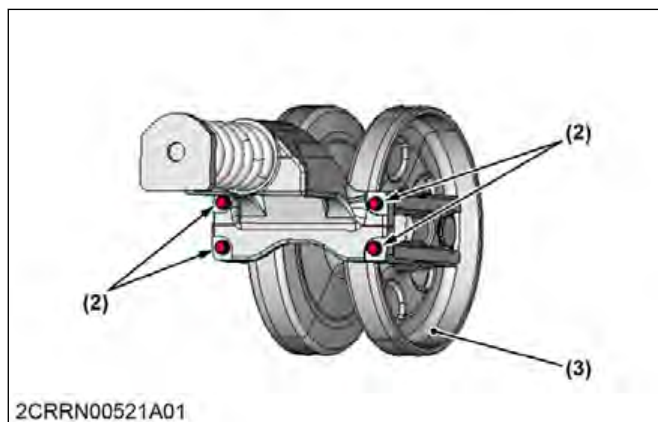


(1) Front idler assembly

Mass

(1) Front idler assembly	Approximately 65 kg Approximately 143 lbs
--------------------------	--

3. Remove the 4 bolts to remove the front idler.



(2) Bolt (M12 × 50) ×4

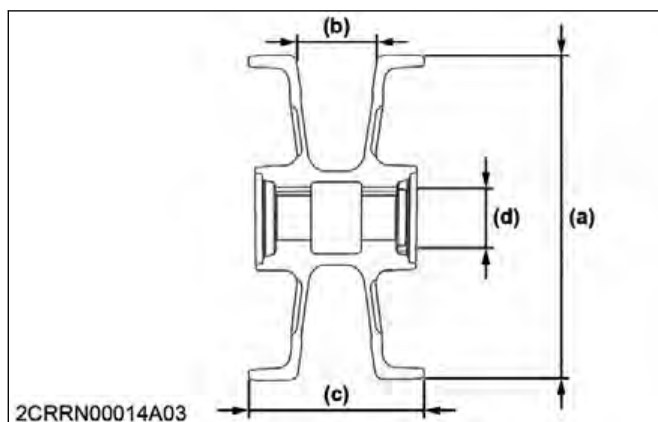
(3) Front idler

Installing

Tightening torque

(2) Bolt	77.5 to 90.2 N · m 7.9 to 9.2 kgf · m 52.1 to 66.5 lbf · ft	Thread lock (Loctite 271)
----------	---	------------------------------

Measuring



Service specifications

	Dimensions
(a) Outer diameter	φ356 mm φ14.0 in.
(b) Guide width	96 mm 3.8 in.
(c) Idler width	204 mm 8.0 in.
(d) Shaft outer diameter	φ45 mm φ1.8 in.

Service limits

	Dimensions
(a) Outer diameter	φ348 mm φ13.7 in.
(b) Guide width	104 mm 4.1 in.
(c) Idler width	—
(d) Shaft outer diameter	φ44 mm φ1.7 in.

3.8 Rear idler**3.8.1 Removing and installing the rear idler****⚠ WARNING**

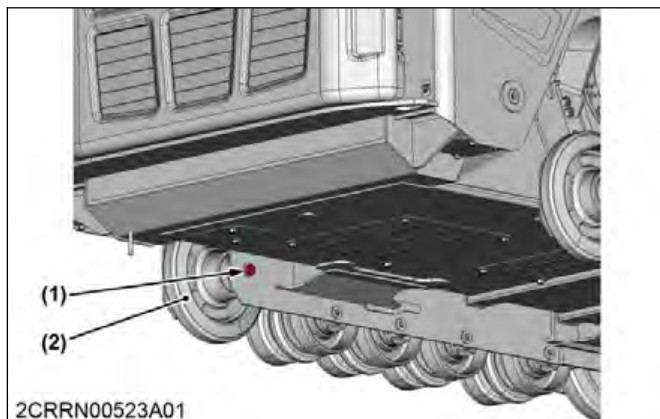
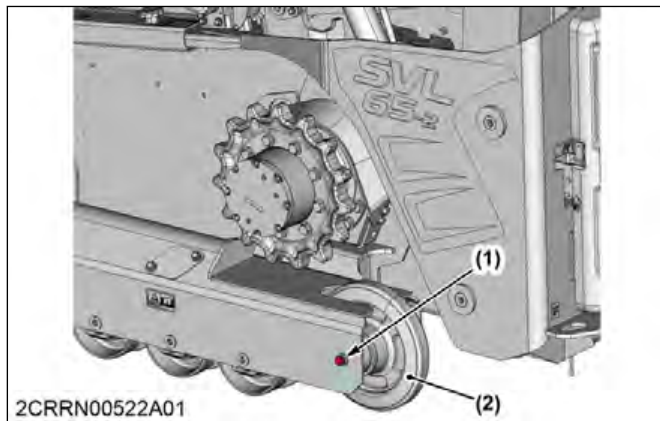
- Place the machine on the jack stands securely when lifting the machine.
- Do not work underneath when the machine is jacked up.
- Keep hands and body away from the rotating track.

Preparing

1. Jack up the machine.
2. Remove the rubber track.

Removing

1. Remove the 2 bolts to remove the rear idler.



(1) Bolt (M16 × 45) ×2

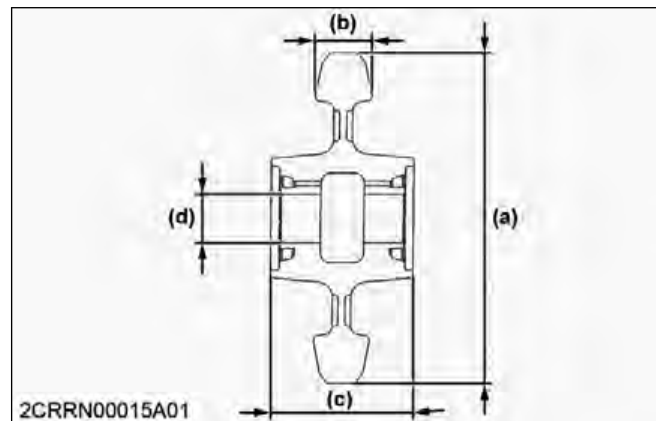
(2) Rear idler

Mass

(2) Rear idler	Approximately 33 kg Approximately 73 lbs
----------------	---

Installing**Tightening torque**

(1) Bolt	344 to 403 N·m 35.1 to 41.1 kgf·m 254 to 297 lbf·ft	Thread lock (Loctite 271)
----------	---	------------------------------

Measuring**Service specifications**

	Dimensions
(a) Idler outer diameter	φ330 mm φ13.0 in.
(b) Guide width	59 mm 2.3 in.
(c) Idler width	145 mm 5.7 in.
(d) Shaft outer diameter	φ45 mm φ1.8 in.

Service limits

	Dimensions
(a) Idler outer diameter	φ320 mm φ12.6 in.
(b) Guide width	49 mm 1.9 in.
(c) Idler width	—
(d) Shaft outer diameter	φ44 mm φ1.7 in.

3.9 Track roller

3.9.1 Removing and installing the track roller

WARNING

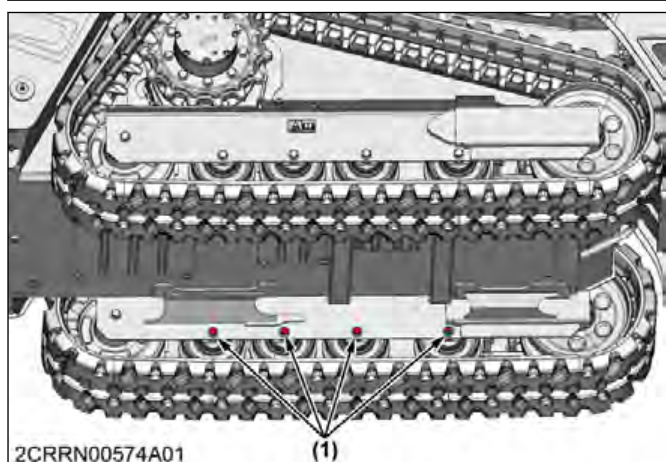
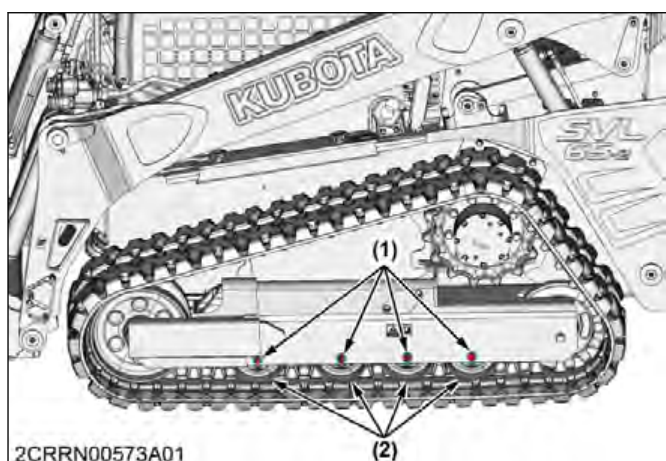
- Place the machine on the jack stands securely when lifting the machine.
- Do not work underneath when the machine is jacked up.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Loosen the grease fitting to loosen the rubber track.
- Jack up the machine.

Removing

- Remove the 8 bolts to remove the track rollers.



(1) Bolt (M16 × 45) ×8

(2) Track roller ×4

Mass

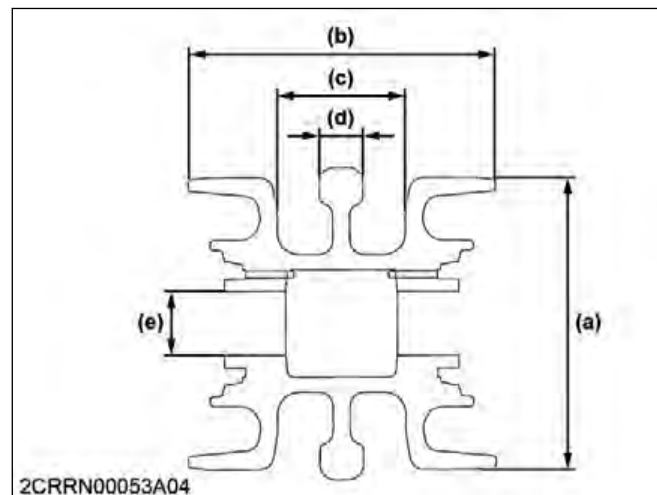
(2) Track roller	Approximately 26 kg Approximately 58 lbs
------------------	---

Installing

Tightening torque

(1) Bolt	344 to 403 N·m 35.1 to 41.1 kgf·m 254 to 297 lbf·ft	Thread lock (Loctite 271)
----------	---	------------------------------

Measuring



Service specifications

	Dimensions
(a) Outer diameter	φ200 mm φ7.9 in.
(b) Track roller width	212 mm 8.3 in.
(c) Guide width 1	88 mm 3.5 in.
(d) Guide width 2	30 mm 1.2 in.
(e) Shaft outer diameter	φ40 mm φ1.6 in.

Service limits

	Dimensions
(a) Outer diameter	φ192 mm φ7.9 in.
(b) Track roller width	—
(c) Guide width 1	96 mm 3.8 in.
(d) Guide width 2	—
(e) Shaft outer diameter	φ39 mm φ1.5 in.

3.10 Tension spring

3.10.1 Removing and installing the tension spring



WARNING

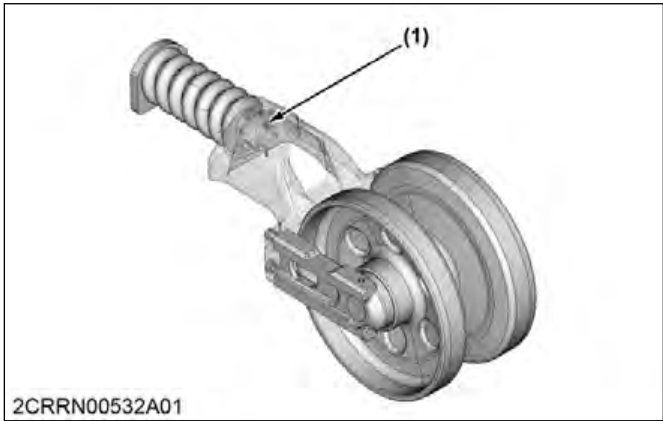
- Place the machine on the jack stands securely when lifting the machine.
- Do not work underneath when the machine is jacked up.
- Keep hands and body away from the rotating track.

Preparing

1. Remove the front idler assembly.

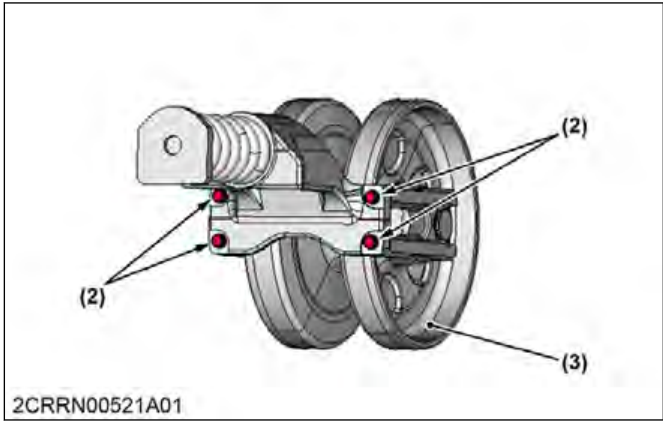
Removing

1. Remove the snap pin.



(1) Snap pin

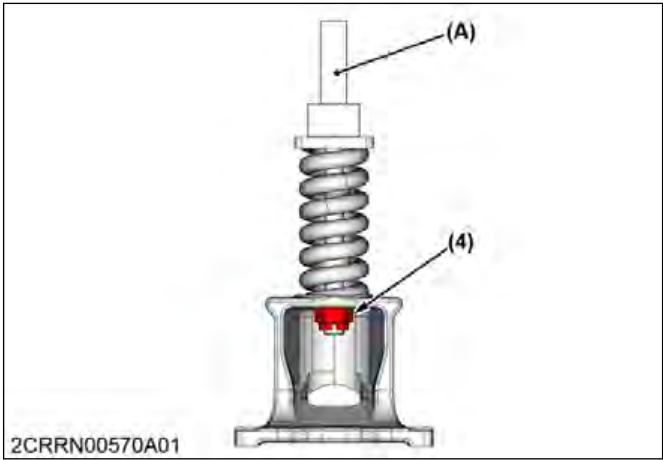
2. Remove the 4 bolts to remove the front idler.



(2) Bolt (M12 × 50) ×4

(3) Front idler

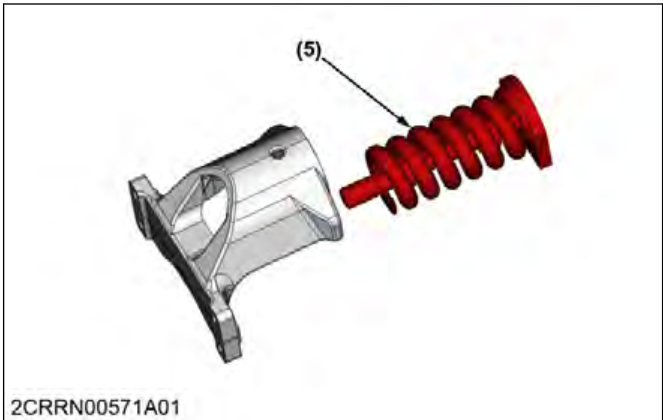
3. Place the tension spring assembly on a press and compress the tension spring to remove the nut.



(4) Nut (M30)

(A) Press

4. Remove the tension spring assembly.

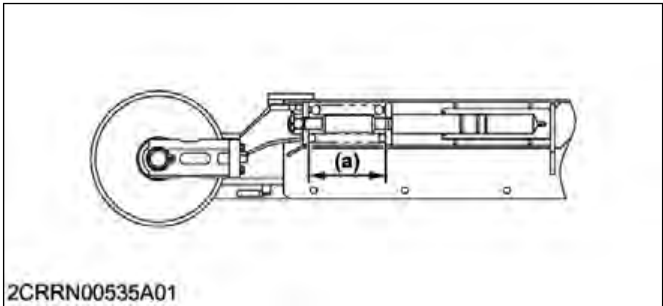


(5) Tension spring assembly

Mass

(3) Tension spring	Approximately 10 kg Approximately 22 lbs
--------------------	---

Installing



Adjusting dimension

(a)	Approximately 203 mm Approximately 8.0 in.
-----	---

3.11 Grease cylinder

3.11.1 Removing the grease cylinder

⚠ WARNING

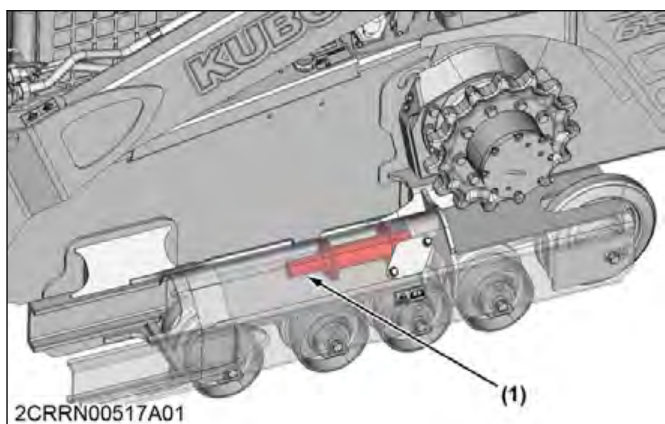
- Place the machine on the jack stands securely when lifting the machine.
- Do not work underneath when the machine is jacked up.
- Keep hands and body away from the rotating track.

Preparing

1. Remove the front idler assembly.

Removing

1. Remove the grease cylinder.



(1) Grease cylinder

Mass

(1) Grease cylinder	Approximately 6.5 kg Approximately 14.3 lbs
---------------------	--

3.12 Quick hitch

3.12.1 Removing and installing the quick hitch

⚠ CAUTION

- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

■ IMPORTANT

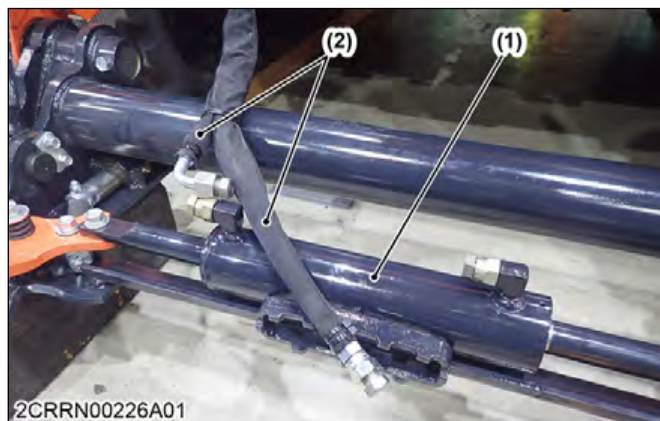
- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Install the vacuum pump to the hydraulic tank and vacuum the hydraulic tank.

Removing

1. Remove the 2 hydraulic hoses from the hydraulic quick hitch cylinder.

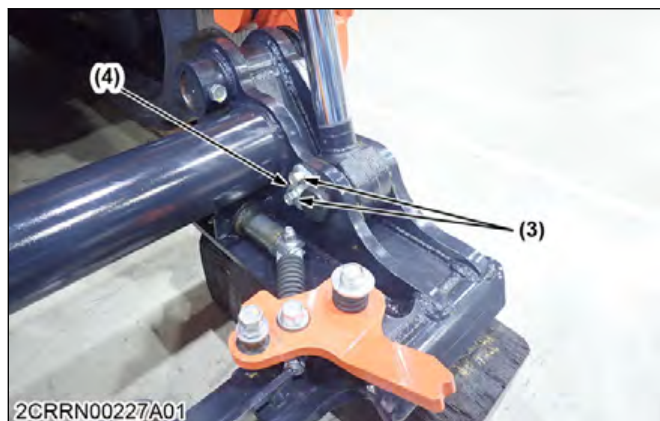


(1) Hydraulic quick hitch cylinder (2) Hydraulic hose ×2

■ NOTE

- This work is required only for hydraulic quick hitch specification.

2. Remove the 2 bolts to remove the guide.



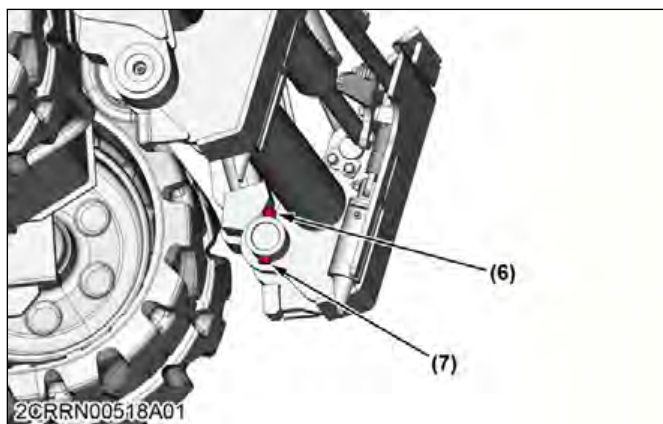
(3) Bolt (M10 × 20) ×2 (4) Guide

3. Remove the pin from the rod side of the bucket cylinder.



(5) Pin

4. Remove the self-locking nut and bolt.



(6) Self-locking nut (M12) (7) Bolt (M12 × 80)

5. Remove the pin and bolt on the opposite side with the same procedure.
6. Attach 2 nylon slings to the quick hitch and hoist for support.
7. Remove the 2 pins.



(8) Pin ×2

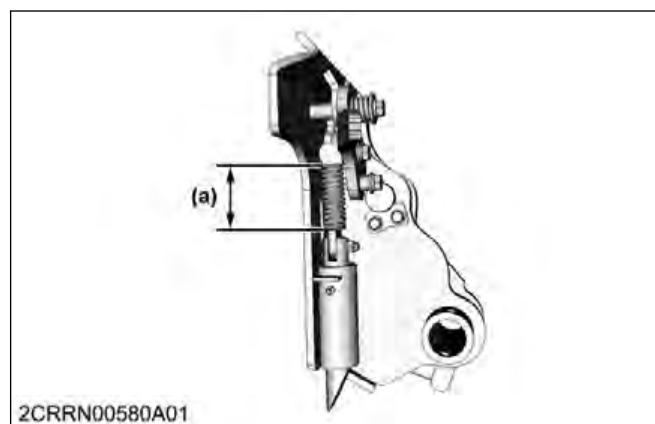
8. Remove the quick hitch.



Mass

Quick hitch	Mechanical hitch	Approximately 60 kg Approximately 132 lbs
	Hydraulic hitch	Approximately 70 kg Approximately 155 lbs

Installing

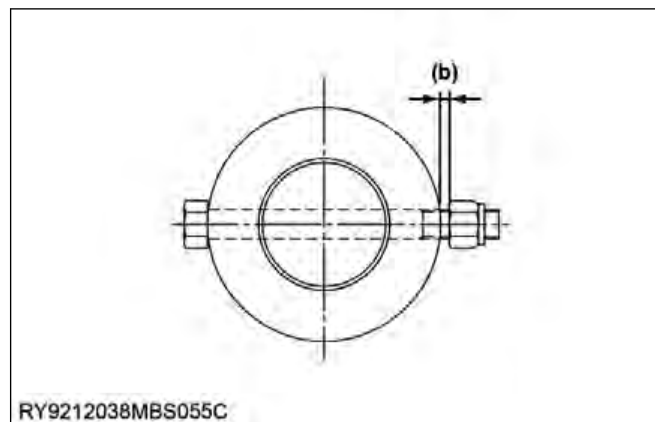


Adjusting dimension

(a)	83 to 84 mm 3.26 to 3.31 in.
-----	---------------------------------

NOTE

- Leave a gap between the self-locking nuts and boss.

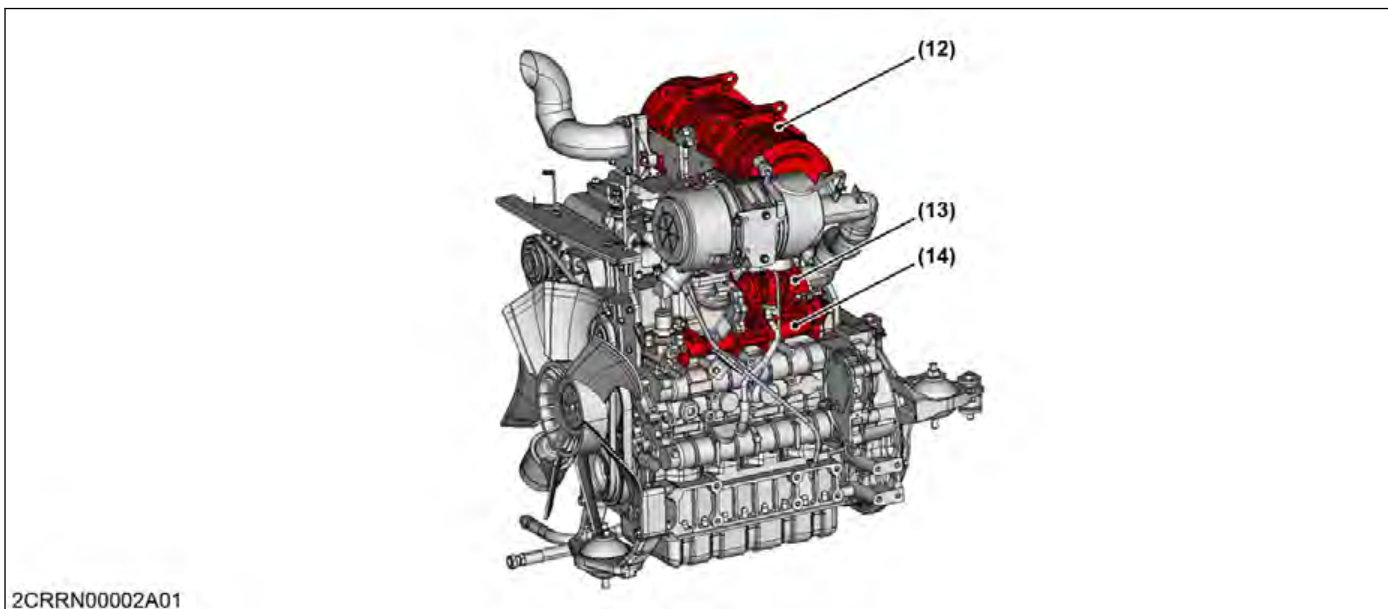
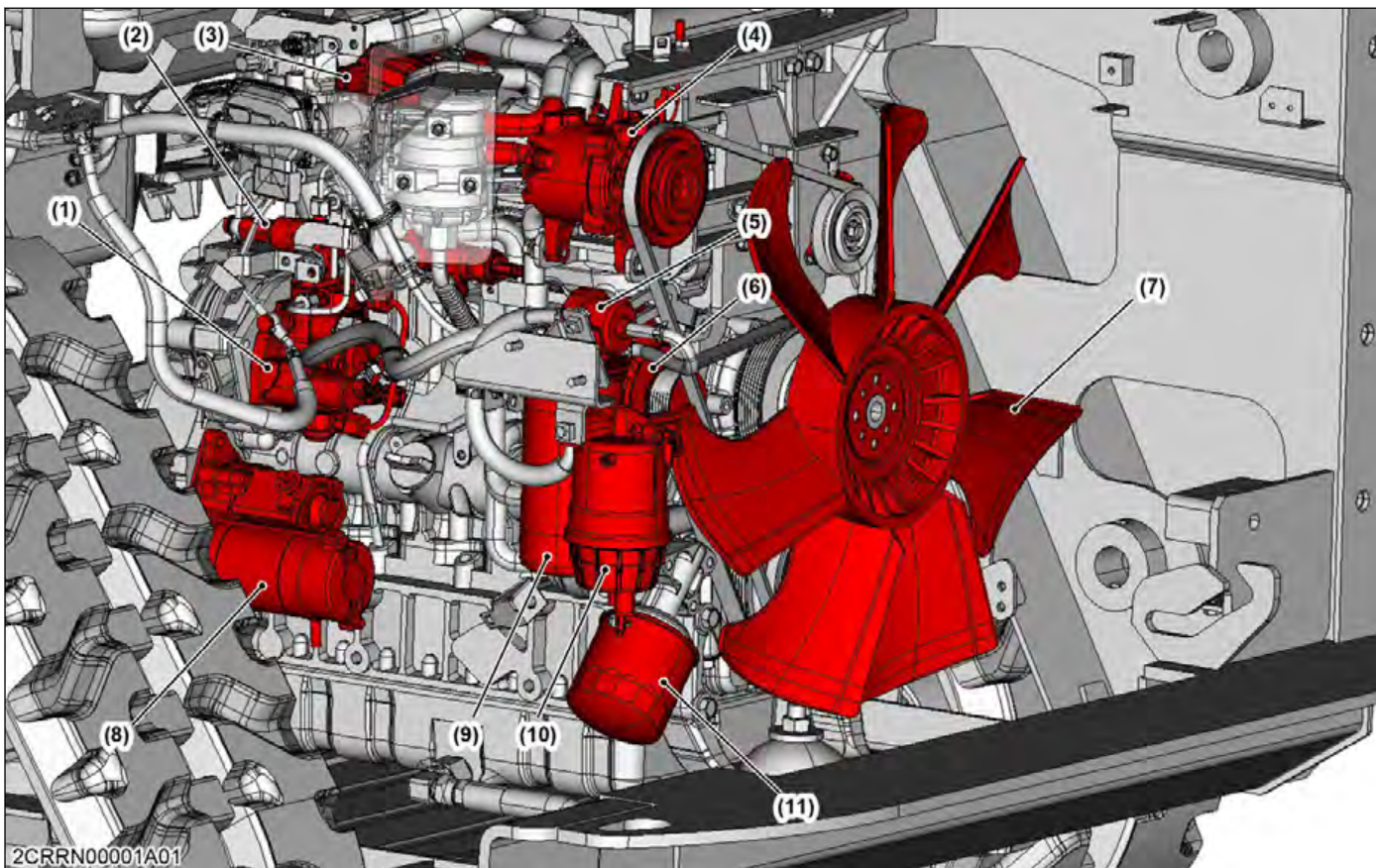


(b) Gap (1.0 to 3.0 mm, 0.04 to 0.12 in.)

5. ENGINE

MECHANISM

1. Engine device layout

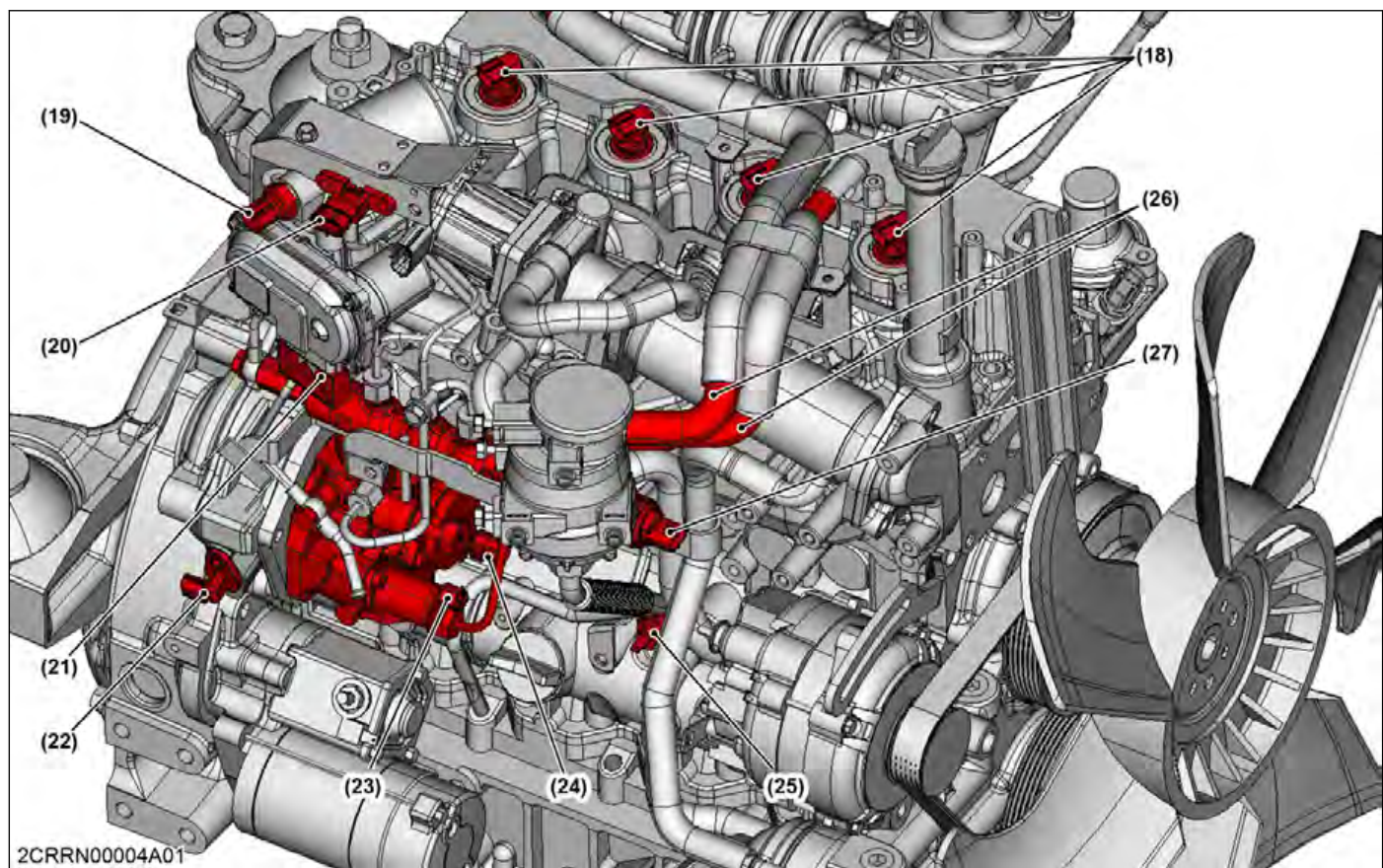
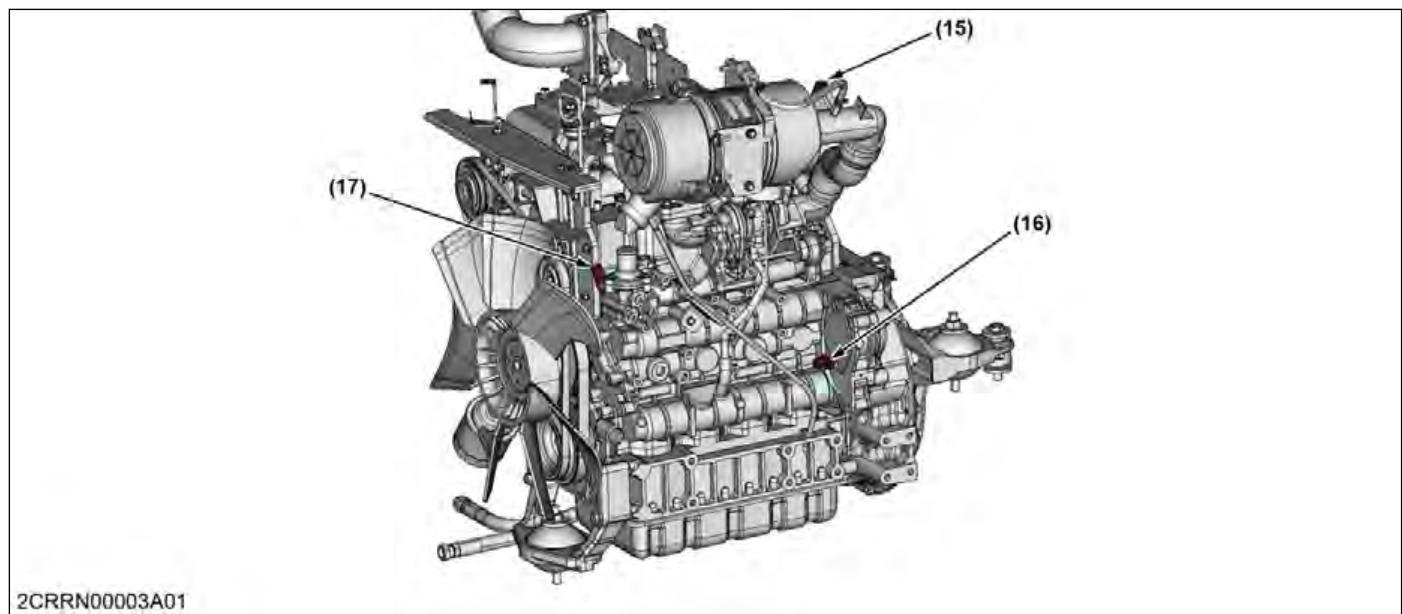


- (1) Supply pump
- (2) Rail
- (3) EGR valve
- (4) Compressor

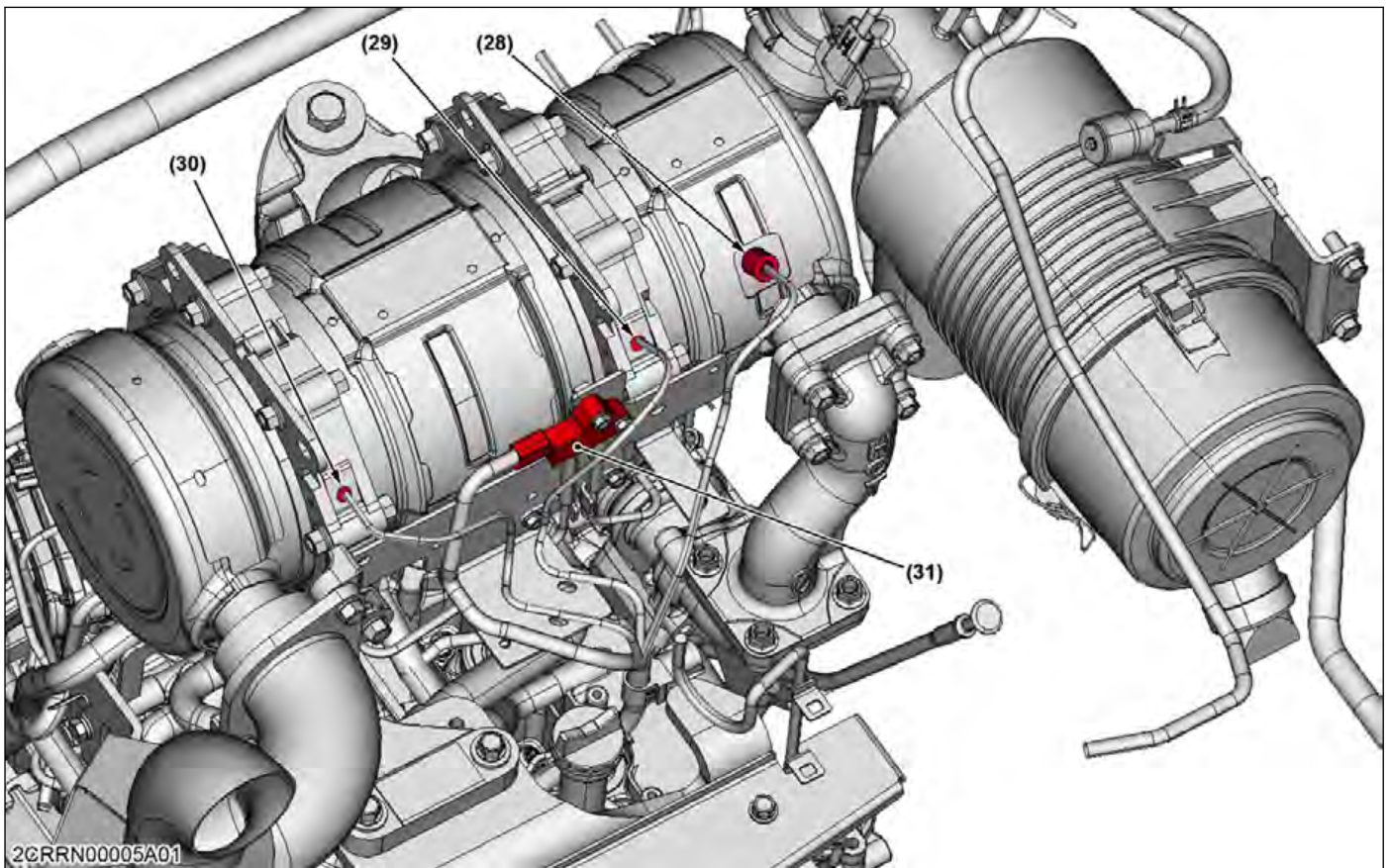
- (5) Fuel feed pump
- (6) Alternator
- (7) Fan
- (8) Starter motor

- (9) Fuel filter
- (10) Water separator
- (11) Engine oil filter
- (12) DPF muffler

- (13) Turbocharger
- (14) Exhaust manifold



- | | | | |
|---------------------------------|---------------------------------|---------------------------------|---------------------------|
| (15) Air flow sensor | (19) Air temperature sensor | (23) SCV | (27) Rail pressure sensor |
| (16) Camshaft position sensor | (20) Boost sensor | (24) Fuel temperature sensor | |
| (17) Coolant temperature sensor | (21) Throttle valve sensor | (25) Engine oil pressure switch | |
| (18) Injector | (22) Crankshaft position sensor | (26) CCV heater | |



(28) DOC inlet temperature sensor (T0) (29) DPF inlet temperature sensor (T1) (30) DPF outlet temperature sensor (T2) (31) Differential pressure sensor (ΔP)

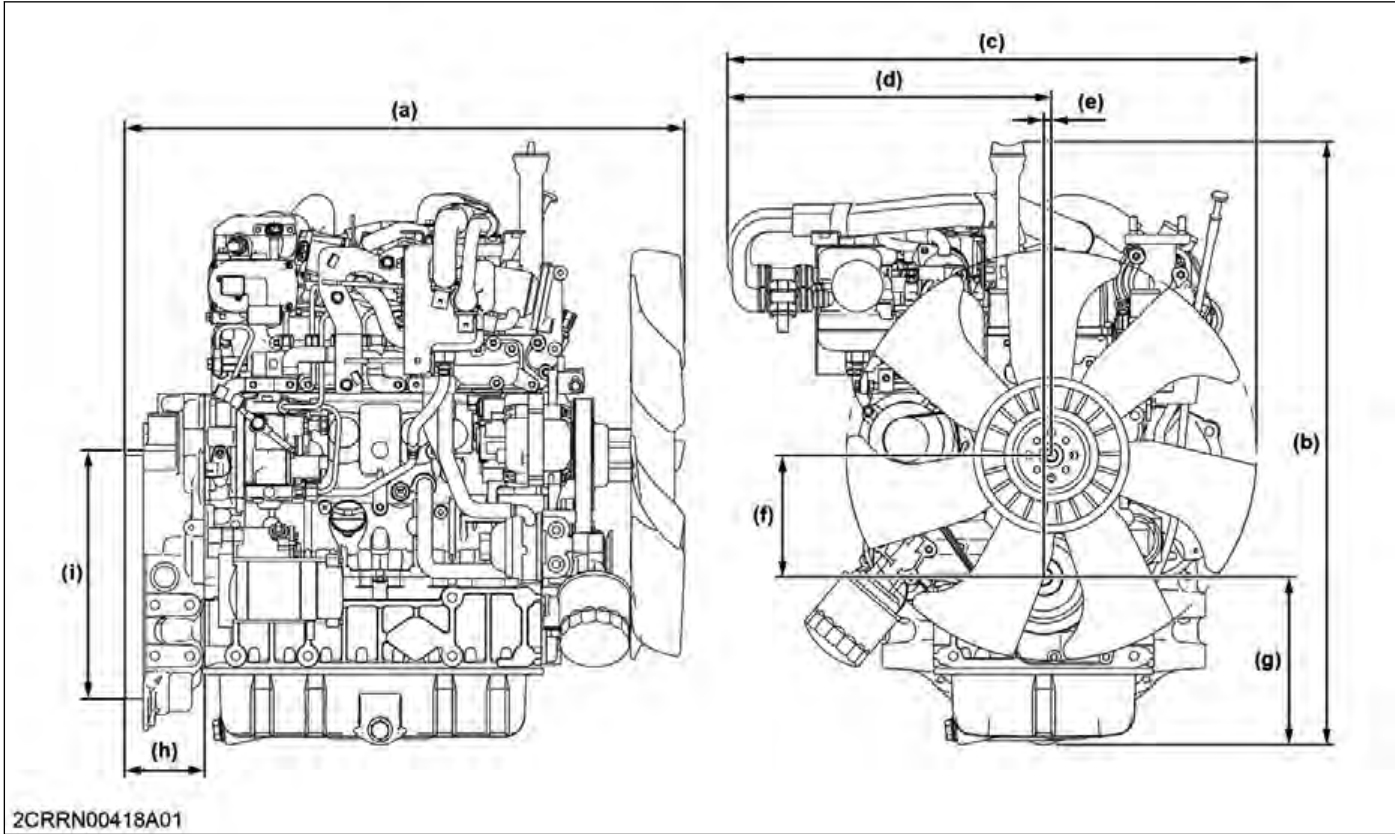
2. Engine specifications

		Specifications	
Model		V2607-CR-TE4-CTL (open cab specification)	V2607-CR-TE4-CTL-Q (closed cab specification)
Number of cylinders		4	
Cylinder bore × stroke		87.0 × 110 mm 3.43 × 4.33 in.	
Total displacement		2615 cm ³ 159.6 cu.in.	
Idling speed		1250 min ⁻¹ (rpm)	
Rated speed		2600 min ⁻¹ (rpm)	
MAX speed		2700 min ⁻¹ (rpm)	
Compression ratio		16.8:1	
Rated output / Rated speed	Net SAE J 1349	44.7 kW / 2600 min ⁻¹ (rpm) 55.9 HP / 2600 min ⁻¹ (rpm)	46.6 kW / 2600 min ⁻¹ (rpm) 62.5 HP / 2600 min ⁻¹ (rpm)
	Net ISO 9249	50.2 kW / 2600 min ⁻¹ (rpm) 67.3 HP / 2600 min ⁻¹ (rpm)	
	Gross SAE J1995	51.0 kW / 2600 min ⁻¹ (rpm) 68.4 HP / 2600 min ⁻¹ (rpm)	
MAX torque / Speed at the MAX torque	Net SAE J 1349	214.9 N·m / 1500 min ⁻¹ (rpm) 21.9 kgf·m / 1500 min ⁻¹ (rpm) 158.5 lbf·ft / 1500 min ⁻¹ (rpm)	217.3 N·m / 1500 min ⁻¹ (rpm) 22.2 kgf·m / 1500 min ⁻¹ (rpm) 160.3 lbf·ft / 1500 min ⁻¹ (rpm)
	Net ISO 9249	214.9 N·m / 1500 min ⁻¹ (rpm) 21.9 kgf·m / 1500 min ⁻¹ (rpm) 158.5 lbf·ft / 1500 min ⁻¹ (rpm)	217.3 N·m / 1500 min ⁻¹ (rpm) 22.2 kgf·m / 1500 min ⁻¹ (rpm) 160.3 lbf·ft / 1500 min ⁻¹ (rpm)
	Gross SAE J1995	225.0 N·m / 1500 min ⁻¹ (rpm) 22.9 kgf·m / 1500 min ⁻¹ (rpm) 166.0 lbf·ft / 1500 min ⁻¹ (rpm)	
Dimensions (L × W × H)		738 × 615 × 725 mm 29.1 × 24.2 × 28.5 in.	
Dry weight		260 kg 573 lbs	
Fuel injection order		1-3-4-2	
Combustion chamber		Direct injection	
EGR		External EGR	
Compression pressure		3.20 MPa 32.6 kgf/cm ² 464 psi	
Fuel consumption (at rated rotation speed)	Net SAE J 1349 JUN95	267.0 g/kW·h 199 g/HP·h 0.44 lb/HP·h	
	Gross SAE J 1995 JUN95	234.0 g/kW·h 174.6 g/HP·h 0.38 lb/HP·h	
Engine oil pressure (at rated rotation speed)		345 kPa 3.5 kgf/cm ² 50 psi	
Engine oil consumption (at rated rotation speed)		1.0 g/kW·h 0.74 g/HP·h 0.0016 lb/HP·h	
Alternator		12 V, 720 W	12 V, 960 W

(Continued)

	Specifications
Charging current	60 A
Battery	12V, BCI 31
Starter motor	12 V, 2.0 kW
Glow plug	1 Ω

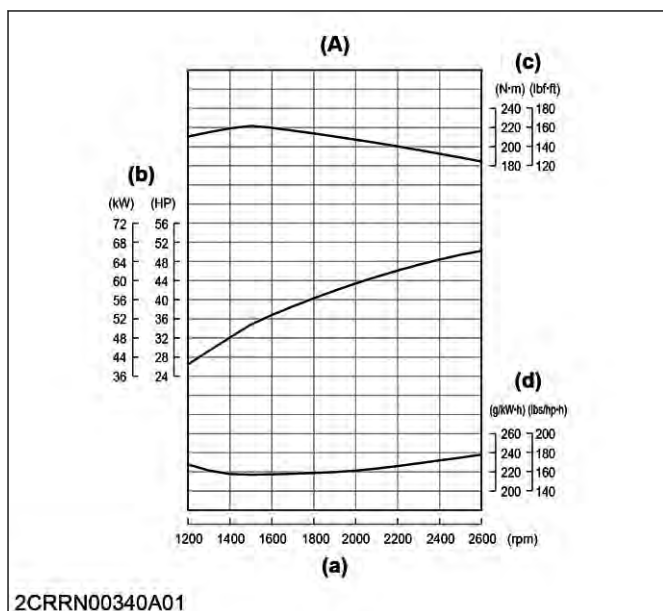
3. Engine dimensions



	Dimensions	No.	Dimensions
(a)	737.2 mm 29.0 in.	(f)	160 mm 6.3 in.
(b)	794 mm 31.3 in.	(g)	221.1 mm 8.7 in.
(c)	696.4 mm 27.4 in.	(h)	105.4 mm 4.15 in.
(d)	426.4 mm 16.8 in.	(i)	φ320.5 mm φ12.6 in.
(e)	10 mm 0.39 in.	—	—

4. Engine performance curves

ISO



(A) Net (ISO 3046-12002)

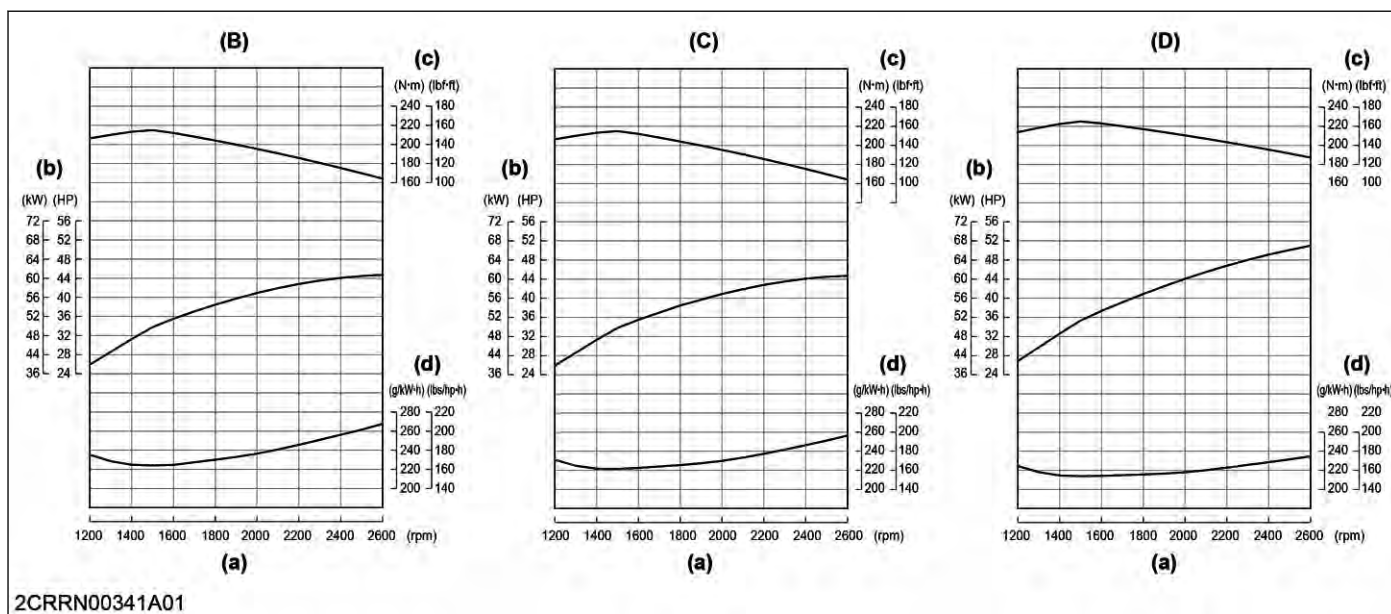
(b) Output

(d) Fuel consumption rate

(a) Engine speed

(c) Torque

SAE



(B) Net (SAE J1349)
Close

(C) Net (SAE J1349)
Open

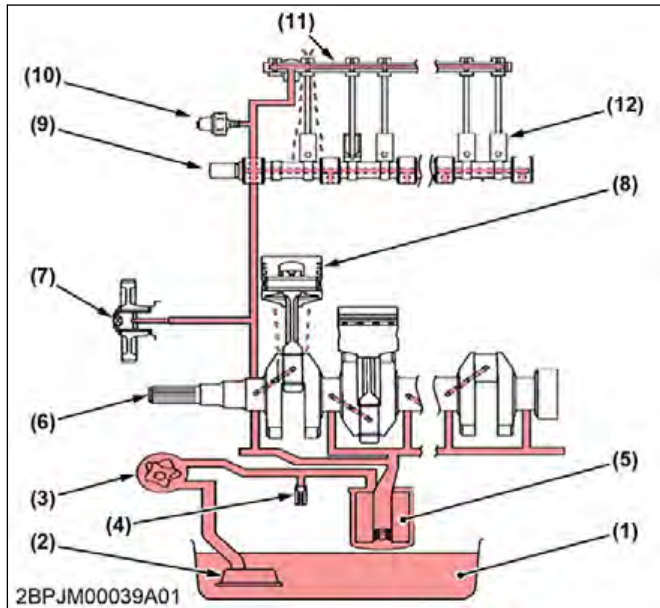
(D) Gross (SAE J1995)
(a) Engine speed
(b) Output

(c) Torque
(d) Fuel consumption rate

5. Lubricating system

5.1 Lubricating system general description

Circulates the engine oil inside the engine for lubrication, cooling, cleaning, sealing, and rust prevention.



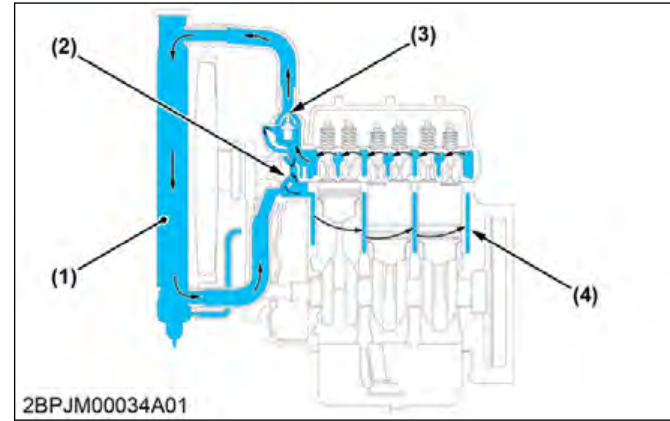
- | | |
|-----------------------|---------------------------------|
| (1) Oil pan | (7) Idle gear |
| (2) Oil strainer | (8) Piston |
| (3) Oil pump | (9) Camshaft |
| (4) Relief valve | (10) Engine oil pressure switch |
| (5) Engine oil filter | (11) Rocker arm |
| (6) Crankshaft | (12) Tappet |

- The engine oil is circulated inside the engine for lubrication, cooling, cleaning, sealing, and rust prevention.
- The oil pump is driven by the crankshaft and discharges the engine oil to the engine oil filter.
- The engine oil filter removes contaminants from the engine oil.
- The engine oil lubricates the piston, connecting rod, crankshaft, camshaft, and so on.
- The engine oil returns to the oil pan.
- The engine oil pressure switch detects the engine oil pressure and conducts the electrical circuit to indicate the engine oil warning lamp in the case of low engine oil pressure.

6. Cooling system

6.1 Cooling system general description

Circulates the coolant inside the engine to prevent overheating.



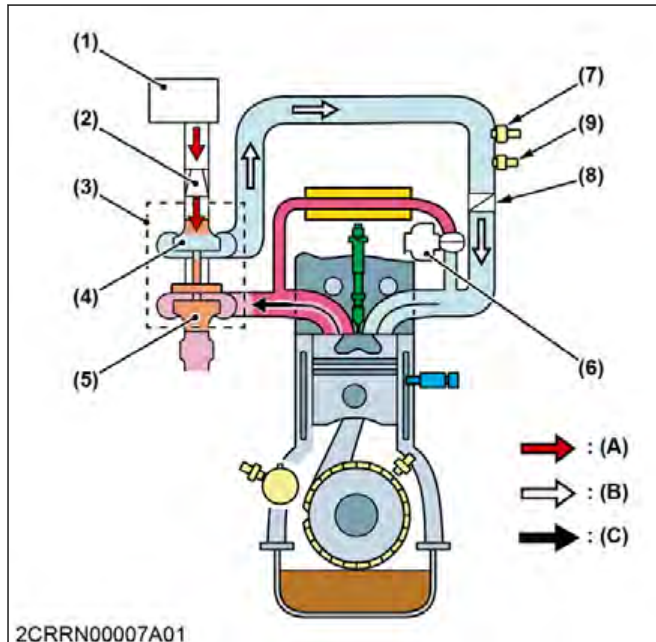
- | | |
|----------------|------------------|
| (1) Radiator | (3) Thermostat |
| (2) Water pump | (4) Water jacket |

- The coolant is circulated inside the engine to prevent overheating.
- The water pump is rotated by the fan belt and discharges the coolant to the water jacket.
- The coolant cools the combustion chamber by passing through the water jacket.
- After passing through the water jacket, the coolant flows to the cylinder head. Then the coolant returns to the radiator.
- The radiator cools the heated coolant by heat exchange.
- According to the coolant temperature, the thermostat regulates the flow rate of the coolant to the radiator.
 - If coolant temperature is low: To warm up the engine, the thermostat closes and the coolant is circulated without passing through the radiator.
 - If coolant temperature is high: To cool the engine, the thermostat opens and the coolant is circulated passing through the radiator.

7. Turbocharger system

7.1 Turbocharger system general description

Compresses the intake air in order to increase the engine output.



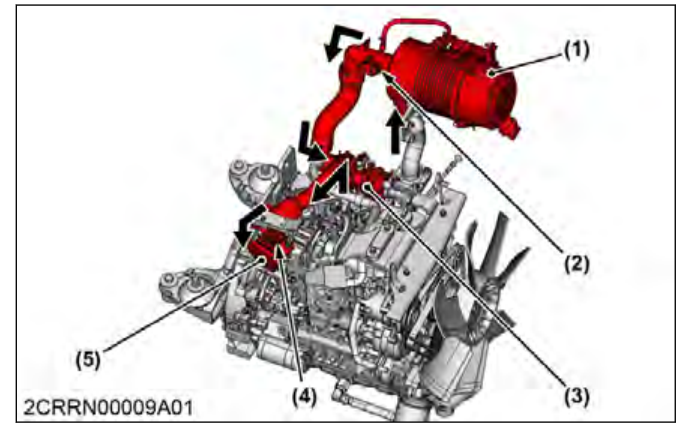
- | | |
|----------------------|-----------------------------------|
| (1) Air cleaner | (8) Throttle valve |
| (2) Air flow sensor | (9) Intake air temperature sensor |
| (3) Turbocharger | |
| (4) Compressor wheel | (A) Intake air stream |
| (5) Turbine | (B) Compressed air stream |
| (6) EGR valve | (C) Exhaust gas stream |
| (7) Boost sensor | |

- The turbine is rotated by the exhaust gas.
- The compressor wheel also rotates powered by the shaft.
- The intake air is compressed by the compressor wheel.
- The oxygen concentration in the intake air increases due to the compression in order to increase the engine output.
- The boost sensor detects the intake air pressure to check the turbocharger performance.

8. Intake air system

8.1 Intake air system general description

The intake air flows to the engine through the air cleaner and turbocharger.



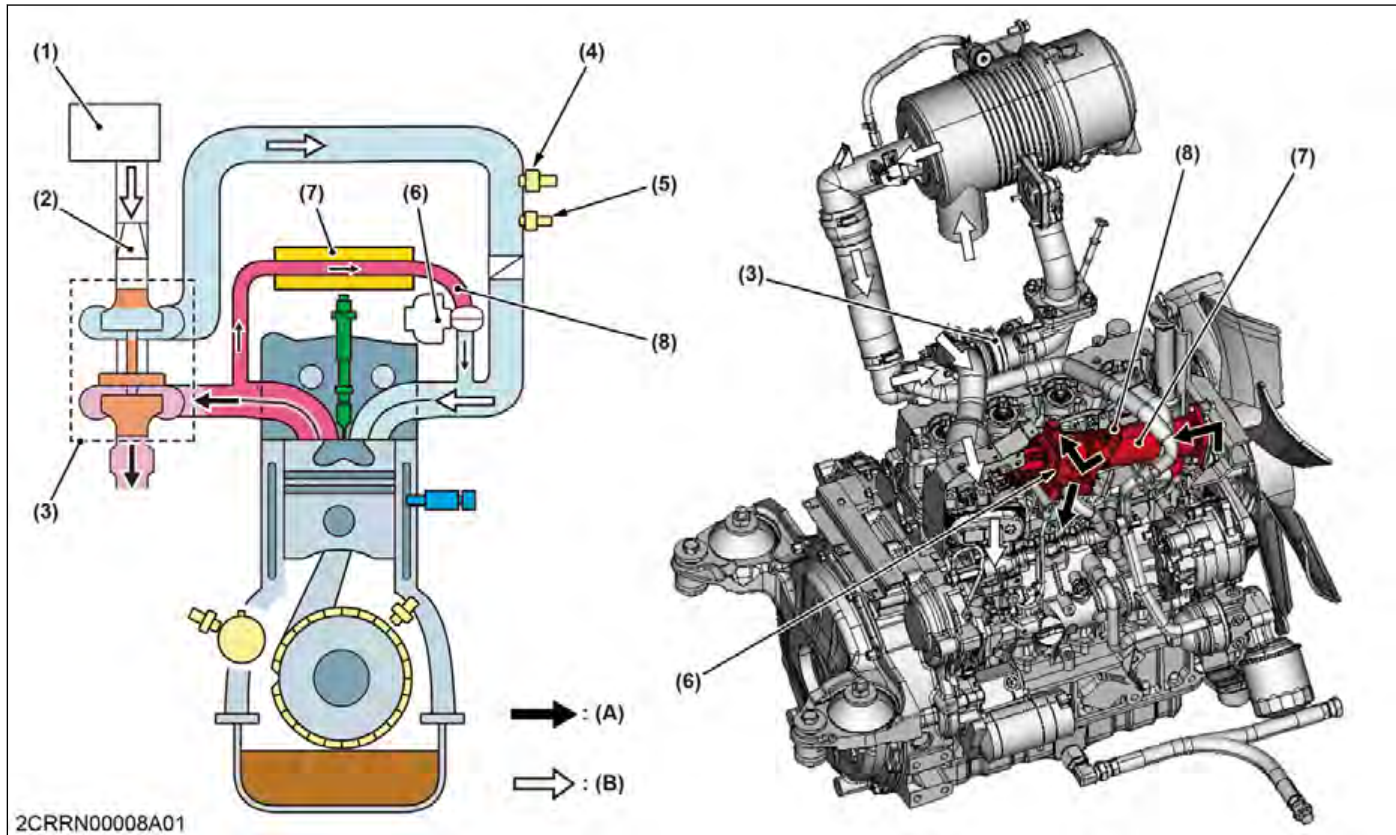
- | | |
|---------------------|--------------------|
| (1) Air cleaner | (4) Boost sensor |
| (2) Air flow sensor | (5) Throttle valve |
| (3) Turbocharger | |

- The ambient air flows to the air cleaner by the negative pressure.
- The air cleaner removes dust from the intake air with the outer and inner elements.
- The air flow sensor detects an amount of the intake air and sends a signal to the engine ECU. The engine ECU controls the EGR valve opening degree according to the signal.
- The turbocharger compresses the intake air to send more air to the engine.
- The boost sensor detects the intake air pressure to check the turbocharger performance.
- For DPF regeneration, the amount of the intake air is regulated by the throttle valve, and the exhaust gas temperature increases.

9. EGR system

9.1 EGR system general description

Reduces NOx (nitrogen oxides) in the exhaust gas by recirculating some of the exhaust gas into the intake air stream.



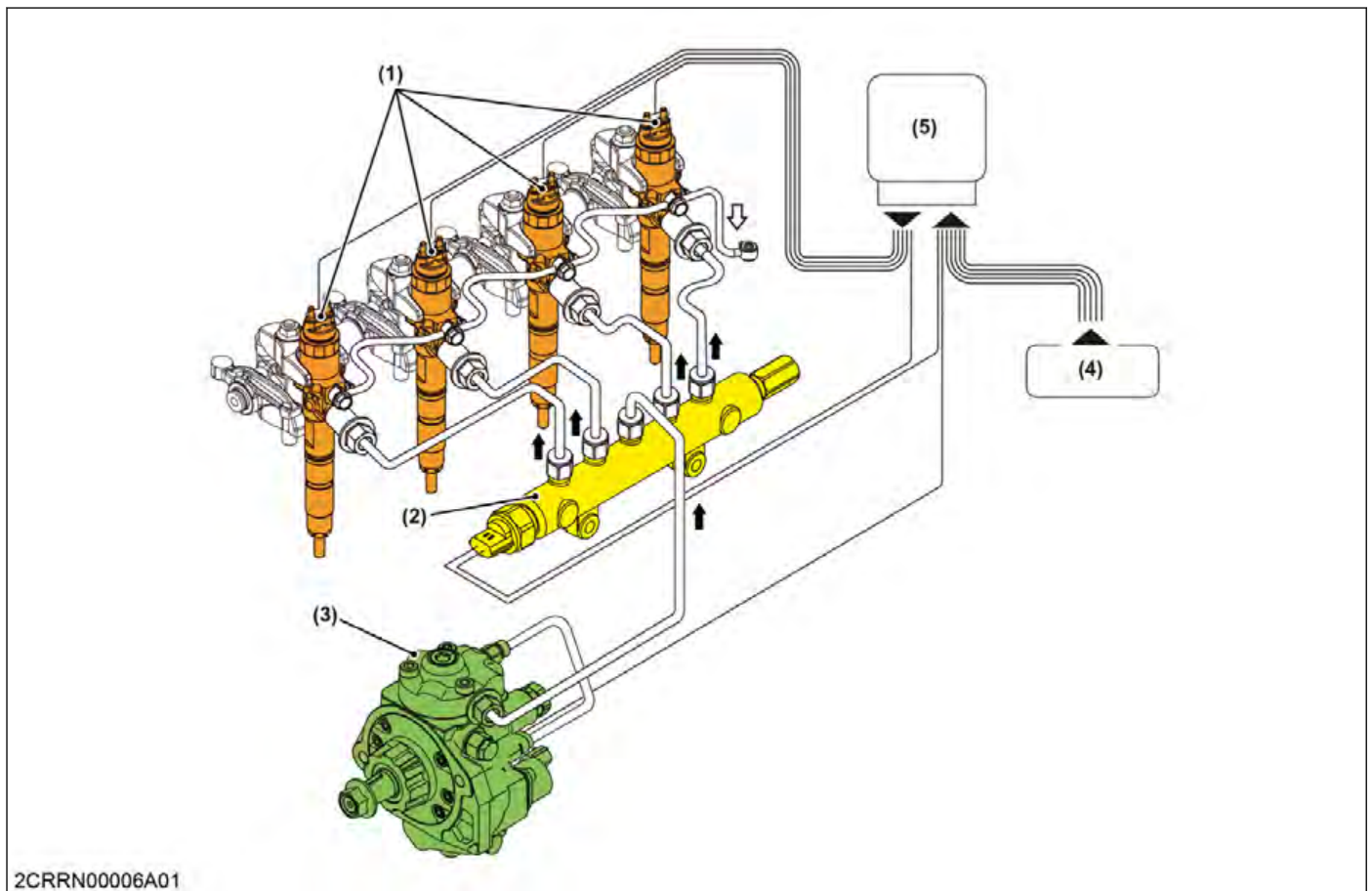
- | | | | |
|---------------------|-----------------------------------|------------------------|-----------------------|
| (1) Air cleaner | (4) Boost sensor | (7) EGR cooler | (B) Intake air stream |
| (2) Air flow sensor | (5) Intake air temperature sensor | (8) EGR pipe | |
| (3) Turbocharger | (6) EGR valve | (A) Exhaust gas stream | |

- The EGR system reduces NOx in the exhaust gas by recirculating some of the exhaust gas which has low oxygen concentration into the intake air stream.
- The EGR system consists of EGR pipe, EGR cooler, and EGR valve.
- The coolant flows inside the EGR cooler to lower the recirculated gas temperature. The charging efficiency of the recirculated gas increases by cooling.
- The EGR valve regulates the flow rate of the recirculated gas into the intake air stream. The engine ECU controls the EGR valve opening degree.

10. Common rail system

10.1 Common rail system general description

Optimally controls the fuel pressure, fuel injection timing, and fuel injection amount for better engine performance (output and fuel consumption) and cleaner exhaust gas.



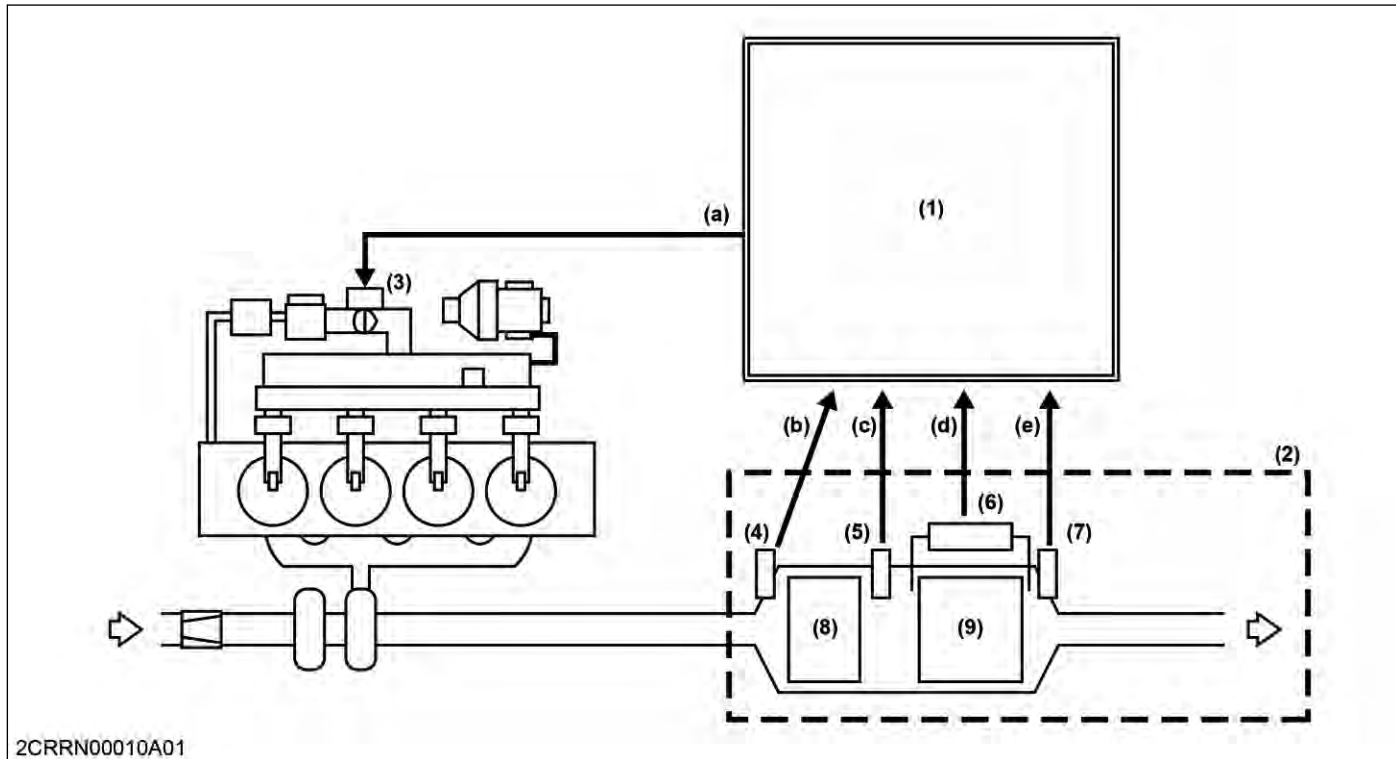
- | | | |
|--------------|-----------------|----------------|
| (1) Injector | (3) Supply pump | (5) Engine ECU |
| (2) Rail | (4) Sensors | |

- The common rail system optimally controls the fuel pressure, fuel injection timing, and fuel injection amount for better engine performance (output and fuel consumption) and cleaner exhaust gas.
- The supply pump discharges pressurized fuel to the rail.
- The rail stores the pressurized fuel and delivers it to the injectors. As the rail stores the fuel, the common rail system can inject the fuel independently from the engine speed.
- The injectors spray the pressurized fuel into the cylinders at the desired pressure, quantity and timing according to the signal from the engine ECU.

11. After treatment system

11.1 Aftertreatment system general description

Reduces the harmful chemicals and the particulate matter in the exhaust gas by the catalytic function and the filter.



- | | | | |
|----------------------------------|---|-----------------------------------|----------------|
| (1) Engine ECU | (5) DPF inlet temperature sensor | (7) DPF outlet temperature sensor | (b) T0 |
| (2) Aftertreatment devices | (6) Differential pressure sensor (ΔP) | (8) DOC | (c) T1 |
| (3) Throttle valve | | (9) DPF | (d) ΔP |
| (4) DOC inlet temperature sensor | | | (e) T2 |
| | | (a) Throttle valve angle | |

- The exhaust gas flows into the DPF muffler.
- The carbon monoxide (CO) and hydrocarbon (HC) in the exhaust gas, which are harmful chemicals, react to the DOC and they are turned into carbon dioxide (CO₂) and water (H₂O).
- The DOC is set in front of the DPF step that uses post-injection unburned fuel to actively regenerate the DPF.
- Reduce the intake air flow rate by the throttle valve when regenerating the DPF muffler.
- Ignition delay is caused by decrease of the intake oxygen amount, and drop the compression pressure. And also that is not enough to conversion of thermal energy to kinetic energy. In consequently increase the exhaust temperature.
- The high temperature exhaust gas to regenerate the DPF muffler is obtained by this control.

11.2 DPF regeneration control

According to the amount of particulate matter deposits (deposit level), the engine output is limited and warning (lamp, error) is displayed.

Deposit level	DPF regeneration inhibit switch ON: Inhibited	Engine speed	Engine output	Warning lamp				Error
								
Level 0	—	—	—	—	—	—	—	—
Level 1	ON	—	—	—	—	—	Lit	—
	OFF	—	—	Lit	—	—	—	—
Level 2	ON	—	—	—	—	—	Blink	“E:9006”
	OFF	1800 rpm or more	—	Lit	—	—	—	—
		1800 rpm or less	—	Lit	Blink	—	—	“E:9000”
Level 3	ON	—	50%	—	—	Blink	Blink	“E:9007”
	OFF	1800 rpm or more	50%	Lit	—	—	—	“E:9002”
		1800 rpm or less	50%	Lit	Blink	Blink	—	“E:9001”
Level 4	ON	—	50%	—	—	Blink	Blink	“E:9003”
	OFF	—	50%	—	—	Blink	—	“E:9003”
Level 5	ON	—	50%	—	—	Blink	Blink	“E:9004”
	OFF	—	50%	—	—	Blink	—	“E:9004”

Level 0

- No need to regenerate the DPF.

Level 1

- The DPF regeneration lamp is lit and the DPF is regenerated.

Level 2

- The DPF is regenerated at 1800 rpm or higher.
- The speed increase lamp blinks and the DPF regeneration lamp is lit, and an error is displayed when the speed is less than 1800 rpm (“E:9000”).

Level 3

- Engine output limit: 50%
- The DPF is regenerated at 1800 rpm or higher, and an error is displayed (“E:9002”).
- The speed increase lamp and the warning lamp blink, the DPF regeneration lamp is lit, and an error is displayed when the speed is less than 1800 rpm (“E:9001”).

Level 4

- Engine output limit: 50%
- There is an excessive amount of the particulate matter deposits, or the DPF regeneration is disabled. In that case, the warning lamp blinks, and an error is displayed (“E:9003”).
- Use the engine diagnostic tool for forced regeneration only.

Level 5

- Engine output limit: 50%
- There is an excessive amount of the particulate matter deposits, or the DPF regeneration/forced regeneration is disabled. In that case, the warning lamp blinks, and an error is displayed (“E:9004”).
- Clean or replace the DPF.

■ NOTE

- Refer to "DPF HANDLING MANUAL (FOR COMPACT TRACK LOADER)" for reusing the DPF after cleaning.

SERVICING

1. Troubleshooting

1.1 Engine troubleshooting

■ NOTE

- Refer to the DM for the CRS related problem.

The engine does not start

Causes	Inspections	Actions
Air or water is mixed in the fuel system.	Check the fuel filter, fuel tank and water separator.	Remove the water from the fuel tank or water separator. Purge the fuel line.
The fuel feed pump is malfunctioning.	Check the condition of the fuel feed pump.	Replace the fuel feed pump.
The fuel hose is clogged.	Check the condition of the fuel hose.	Clean or replace the fuel hose.
The fuel is too viscous.	Check the fuel filter, fuel tank and water separator.	Remove the water from the water separator. Replace the fuel filter. Replace the fuel.
The supply pump is malfunctioning.	Check the condition of the supply pump.	Replace the supply pump.
The engine oil and fuel has become too viscous due to low temperature.	—	Use specified fuel or engine oil.
The battery voltage is too low. The starter motor speed is low.	Check the battery voltage.	Recharge or replace the battery.
The fuel filter is clogged.	Check the condition of the fuel filter.	Replace the fuel filter.
The compression pressure is insufficient.	Check the compression pressure.	Follow the engine WSM to repair.

The engine power is insufficient

Causes	Inspections	Actions
The fuel level is low.	Check the fuel level by the fuel gauge.	Refuel.
The air cleaner is clogged.	Check if the air cleaner is clogged.	Clean the outer elements. Replace the inner and outer element of the air cleaner.
Piston ring is damaged. Valve is damaged.	Check the engine compression pressure.	Follow the engine WSM to repair.
The supply pump is malfunctioning.	Check the condition of the supply pump.	Replace the supply pump.
The injector is malfunctioning.	Check the condition of the injector.	Replace the injector.
The compression pressure is insufficient.	Check the compression pressure.	Specify the cause of the insufficient compression pressure.
An air leakage is occurring in the turbocharger.	Check the condition of the turbocharger.	Replace the turbocharger.

The engine is hunting

Causes	Inspections	Actions
The fuel filter is clogged.	Check the condition of the fuel filter.	Replace the fuel filter.
The air cleaner is clogged.	Check the condition of the air cleaner.	Clean or replace the air cleaner.
Fuel is leaking from the injection pipe.	Check the condition of the injection pipe.	Tighten the injection pipe bolts. Replace the injection pipe.
The supply pump is malfunctioning.	Check the condition of the supply pump.	Replace the supply pump.
The injector is malfunctioning.	Check the condition of the injector.	Replace the injector.
Air is leaking from the intake air line.	Check the each hose of the intake air line. Check the condition of the turbocharger.	Tighten each clamp. Install each hose firmly. Replace the turbocharger.

The exhaust gas color is abnormal

Causes	Inspections	Actions
The fuel quality is low.	—	Change to fuel with proper quality.
Too much engine oil is added.	Check the engine oil level with the engine oil gauge.	Drain the engine oil to adjust the oil level.
Engine oil is leaking from the piston ring, piston or cylinder.	Check the condition of the piston ring, piston and cylinder.	Replace the piston ring. Replace the piston. Repair the cylinder.
The air cleaner is clogged.	Check the condition of the air cleaner.	Clean the air cleaner element.
The fuel filter is clogged.	Check the condition of the fuel filter.	Replace the fuel filter.
The injector is malfunctioning.	Check the condition of the injector.	Replace the injector.
The DPF is damaged.	Check the condition of the DPF.	Replace the DPF.

The engine is overheating

Causes	Inspections	Actions
The coolant level is low.	Check the coolant level in the reserve tank.	Fill the reserve tank with the coolant.
The radiator fins are clogged.	Check if the radiator fins are clogged. Check the coolant pipe.	Clean the radiator.
The radiator cap is damaged.	Check the radiator cap.	Replace the radiator cap.
The thermostat is damaged.	Check the thermostat.	Replace the thermostat.
The engine oil level is low.	Check the engine oil level with the engine oil gauge.	Fill with the engine oil.
The fan belt is damaged.	Check the fan belt. Check the tension of the fan belt.	Replace the fan belt. Adjust the fan belt tension.
The water pump seal is damaged.	Check the water pump seal.	Replace the water pump seal.
Rust is mixed in the coolant.	Check the condition of the coolant.	Replace the coolant.
The cylinder head gasket is damaged.	Check the damage and oil leakage around the cylinder head.	Replace the cylinder head gasket.
The fuel injection timing is incorrect.	Check if the injection timing is correct.	Adjust the injection timing.
The fuel quality is low.	—	Change to the fuel with proper quality.

2. Service specifications

2.1 Service specifications for engine

			Units	Service specifications		Service limits
				Value	Tolerance	Value
Pressure	Compression pressure		MPa	3.20	—	2.00
			kgf/cm ²	32.6		20.4
			psi	464		290
	Engine oil pressure	MAX speed	kPa	345	±95	150
			kgf/cm ²	3.5	±1.0	1.5
			psi	50	±14	21

3. Testing

3.1 Measuring the engine compression pressure



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep hands and body away from the rotating fan and belt.

IMPORTANT

- Measure each cylinder individually to measure the correct value.
- Plug the removed hoses and pipes to avoid dust contamination.
- Do not re-use the used gasket of the fuel injector.

Preparing

- Open the rear bonnet and insert the pin into the lock position.



CAUTION

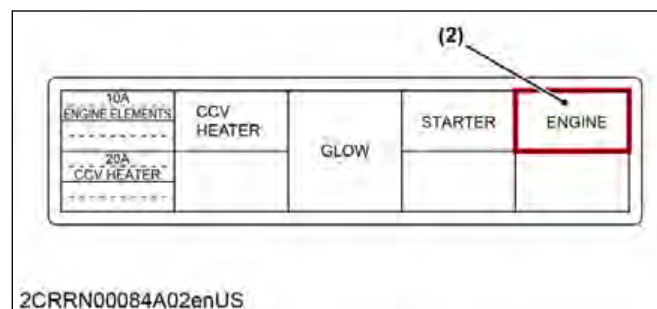
- Check that the rear bonnet is securely locked.

- Open the upper bonnet.
- Disconnect the negative (-) terminal from the battery.
- Remove the engine relay.



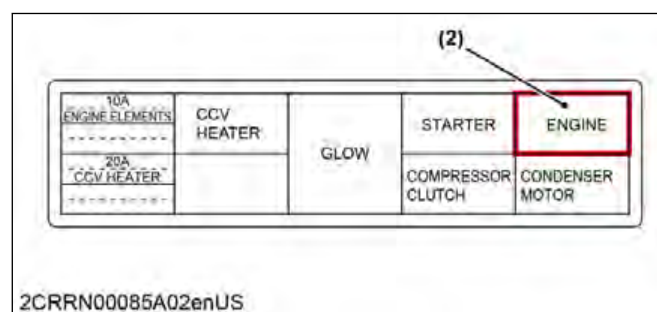
(1) Relay box

Open cab specification



(2) Engine relay

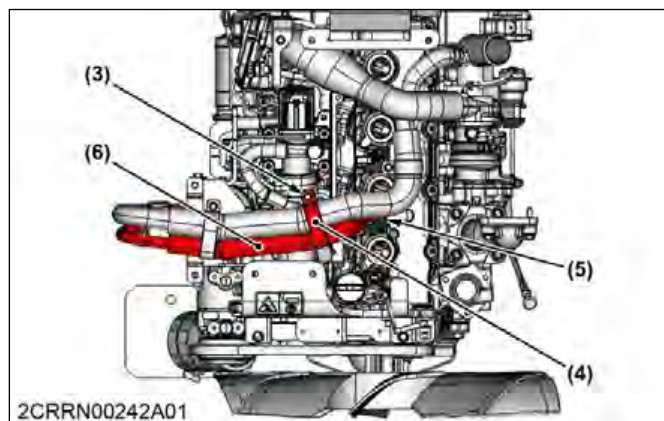
Closed cab specification



(2) Engine relay

- Remove the upper bonnet and the DPF muffler.
- Remove the bolts and hose clamps.

7. Remove the heater hose on the engine side.



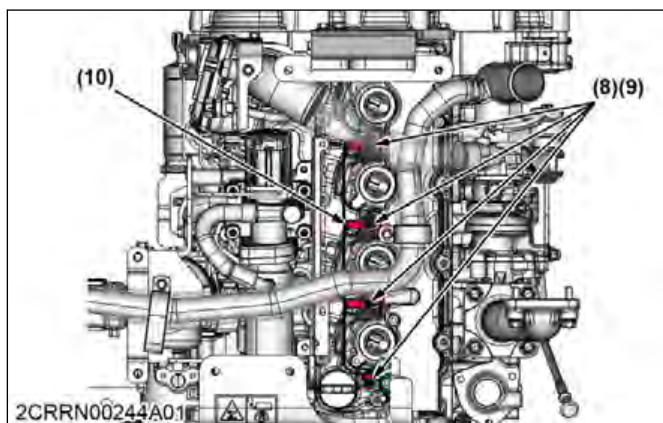
- (3) Bolt (M6 × 12) × 2
(4) Hose clamp
(5) Hose clamp
(6) Heater hose

8. Remove the 4 connectors from the injectors.



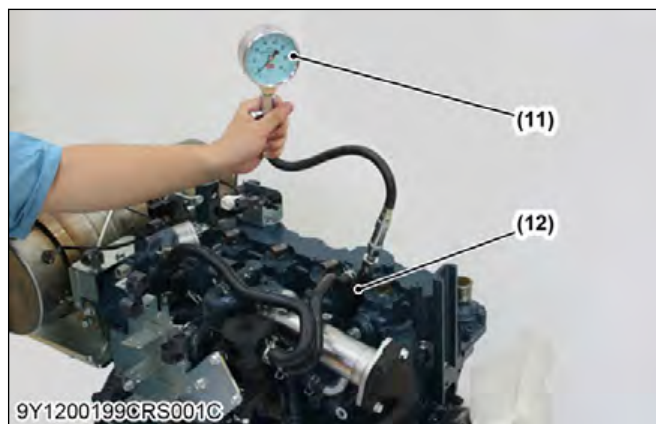
- (7) Connector × 4

9. Remove the 4 nuts to remove the glow lead and the 4 glow plugs.



- (8) Nut × 4
(9) Glow plug × 4
(10) Glow lead

10. Install a compression tester with a glow plug adapter to the glow plug hole.



- (11) Compression tester
(12) Glow plug adapter

11. Connect the negative (-) terminal to the battery.

Measuring

1. Crank the engine.
2. Measure the compression pressure with a compression tester.

Service specification

Compression pressure	3.20 MPa 32.6 kgf/cm ² 464 psi
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Service limit

Compression pressure	2.00 MPa 20.4 kgf/cm ² 290 psi
----------------------	---

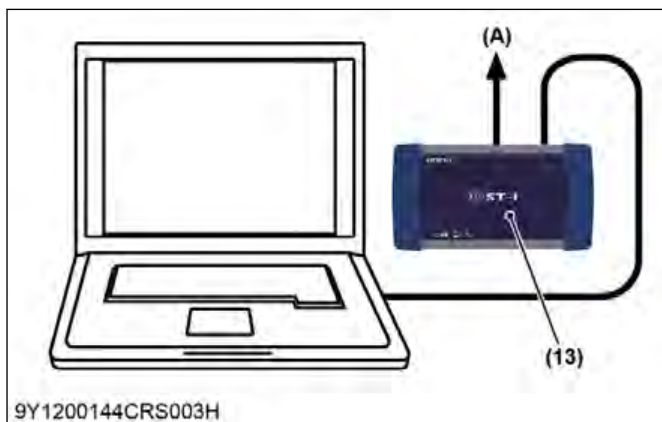
Installing

Tightening torque

(8) Nut	0.98 to 1.70 N·m 0.10 to 0.18 kgf·m 0.73 to 1.30 lbf·ft	-
(9) Glow plug	7.7 to 9.3 N·m 0.78 to 0.95 kgf·m 5.7 to 6.8 lbf·ft	-

Concluding

1. Operate the service dealer mode “no-10” to clear all error history from the memory.
2. Use the Diagmaster to perform the following task.
 - “Clear DTC”.



(13) DST-i

(A) Service tool connector

3.2 Measuring engine oil pressure

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, muffler, and oil are extremely hot.
 - Pressure in the engine oil line is high.
- Keep hands and body away from the rotating fan and belt.
- Before measuring, make sure that the front attachment control lever lock is pressed.

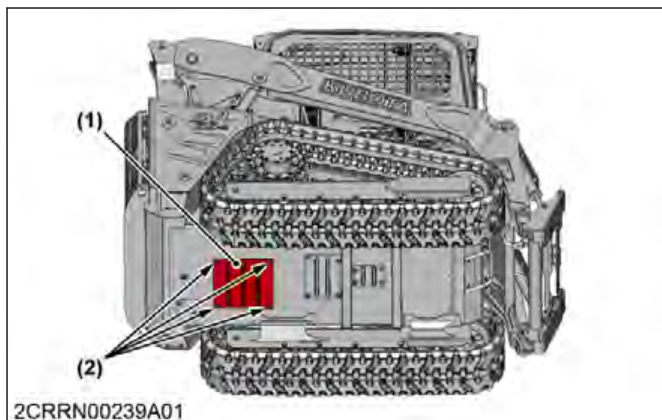
Preparing

- Lower the front attachment to the ground, and stop the engine.
- Jack up the machine.
- Open the rear bonnet and insert the pin into the lock position.

CAUTION

- Check that the rear bonnet is securely locked.

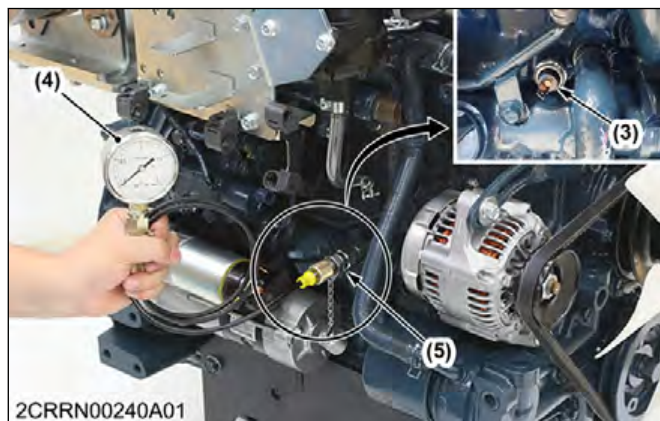
- Open the upper bonnet.
- Tilt the radiator and oil cooler.
- Remove the 4 bolts to remove the cover.



(1) Cover

(2) Bolt (M12 × 30) ×4

- Remove the engine oil pressure switch.
- Install a pressure tester with the pressure tester adapter.



(3) Engine oil pressure switch

(5) Pressure tester adapter

(4) Pressure tester

IMPORTANT

- Wrap thread seal tape around the pressure tester adapter to avoid oil leakage.

- Warm up the engine.

Measuring

- Start the engine.
- Measure the engine oil pressure at the maximum speed.
- After measuring the engine oil pressure, install the engine oil pressure switch with the specified torque.

IMPORTANT

- Wrap thread seal tape around the engine oil pressure switch to avoid oil leakage.

Tightening torque

Engine oil pressure switch	15 to 19 N · m 1.5 to 2.0 kgf/cm ² 11 to 14 lbf · ft	—
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Service specifications

Engine oil pressure	MAX speed	245 to 441 kPa 2.5 to 4.5 kgf/cm ² 36 to 64 psi
---------------------	-----------	--

Service limits

Engine oil pressure	MAX speed	150 kPa 1.5 kgf/cm ² 21 psi
---------------------	-----------	--

4. Repairing

4.1 Fuel hose and tank

4.1.1 Removing and installing the fuel tank

CAUTION

- Keep fire and flammable items away from the working area.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

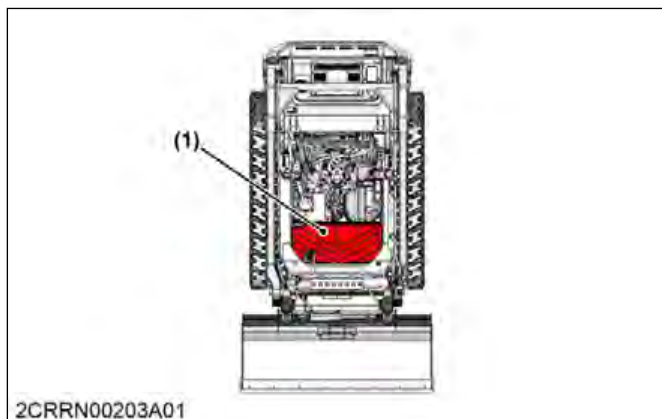
- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Jack up the machine.
3. Tilt up the cab.
4. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.

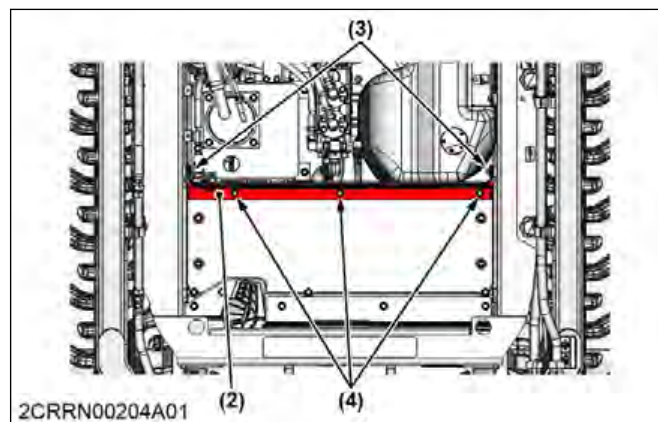
Removing

1. Remove the floor mat.



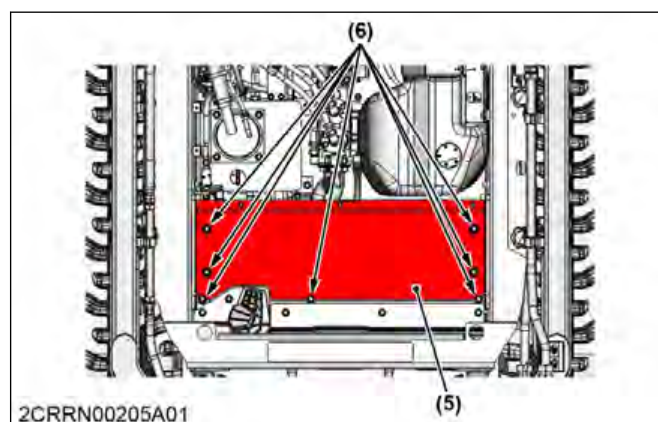
(1) Floor mat

2. Remove the 5 bolts to remove the bracket.



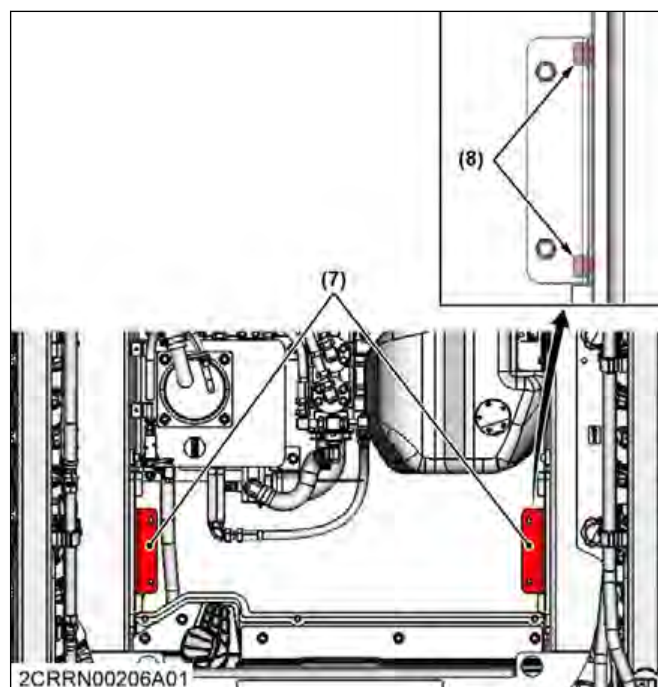
(2) Bracket (4) Bolt (M10 × 20) × 3
(3) Bolt (M10 × 25) × 2

3. Remove the 7 bolts to remove the step.



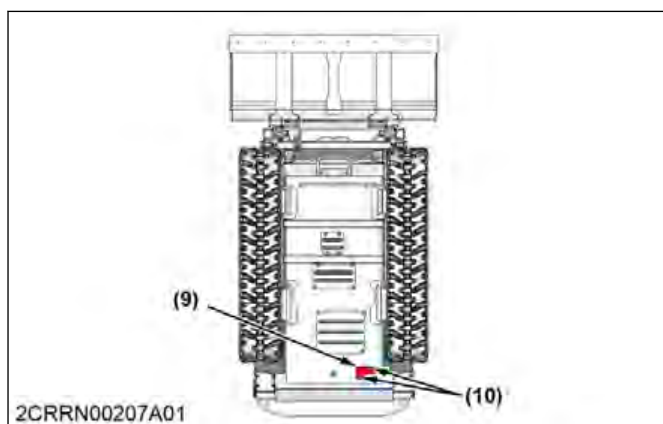
(5) Step (6) Bolt (M10 × 20) × 7

4. Remove the 4 bolts to remove the 2 brackets.



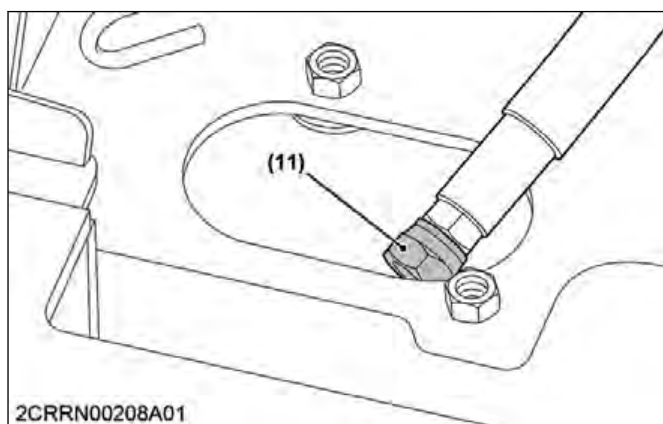
(7) Bracket × 2 (8) Bolt (M10 × 20) × 4

5. Remove the 2 bolts to remove the cover.



(9) Cover (10) Bolt (M12 × 30) × 2

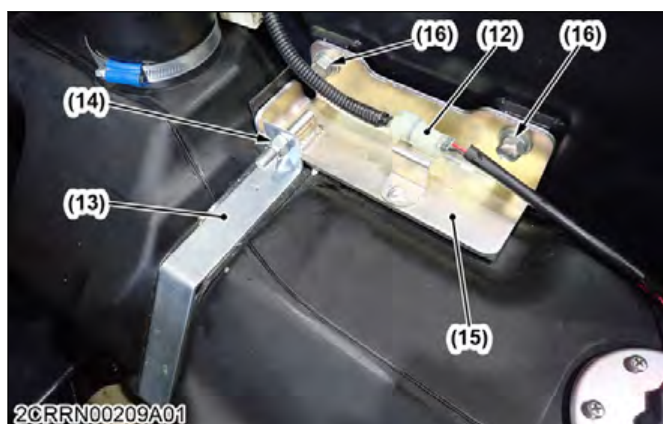
6. Remove the drain plug, and drain the fuel.



(11) Drain plug

7. Disconnect the fuel sensor connector.

8. Remove the nut, band, and 2 bolts, to remove the bracket.



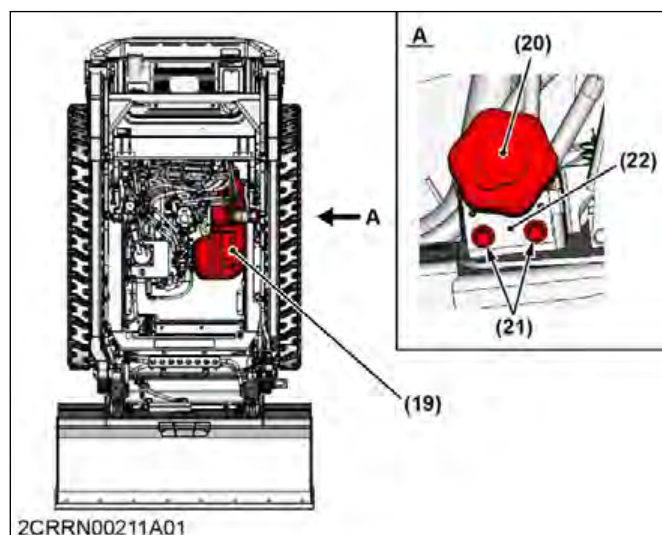
(12) Fuel sensor connector (15) Bracket
(13) Band (16) Bolt (M10 × 25) × 2
(14) Nut (M10)

9. Remove the clamp and the fuel hose.



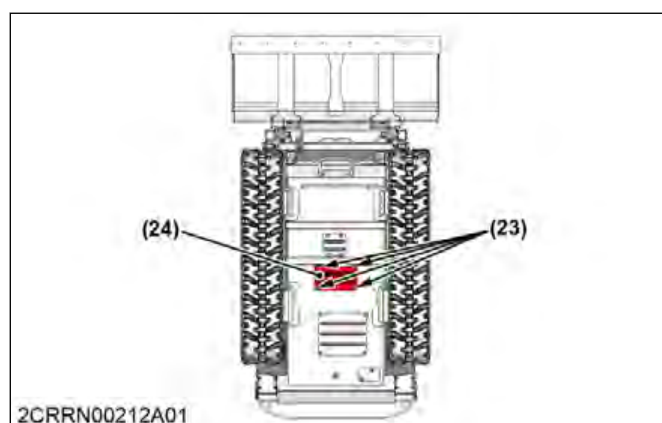
(17) Clamp (18) Fuel hose

10. Remove the cap and 2 bolts to remove the bracket.



(19) Fuel tank (22) Bracket
(20) Cap
(21) Bolt (M10 × 25) × 2

11. Remove the 4 bolts to remove the cover.



(23) Bolt (M12 × 30) × 4 (24) Cover

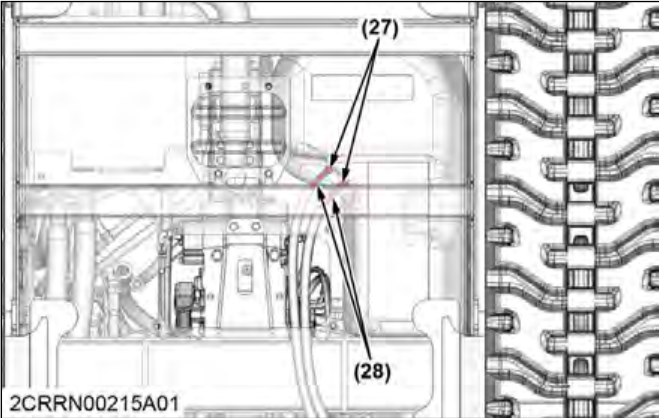
12. Remove the hose.

13. Loosen and turn the adapter to remove the fuel tank.



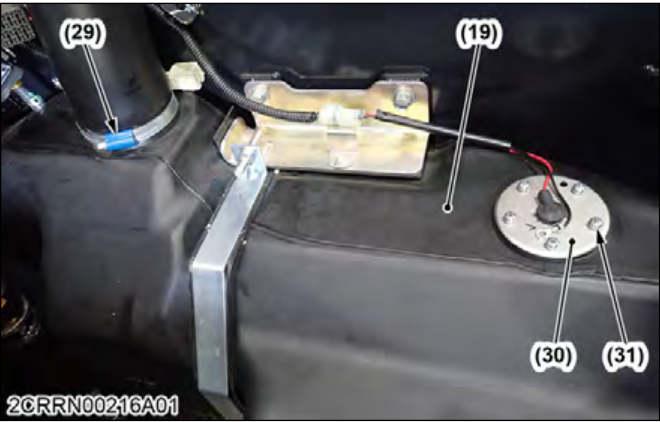
(19) Fuel tank
(25) Hose
(26) Adapter

14. Tighten the adapter.
15. Remove the 2 hose clamps and the 2 hoses.



(27) Hose clamp ×2
(28) Hose ×2

16. Remove the fuel tank.
17. Remove the 5 screws to remove the fuel sensor.



(19) Fuel tank
(29) Hose clamp
(30) Fuel sensor
(31) Screw ×5

Mass

(19) Fuel tank	Approximately 8.0 kg Approximately 18 lbs
----------------	--

NOTE

- These values are the empty weight of the fuel tank.

Installing

Tightening torque

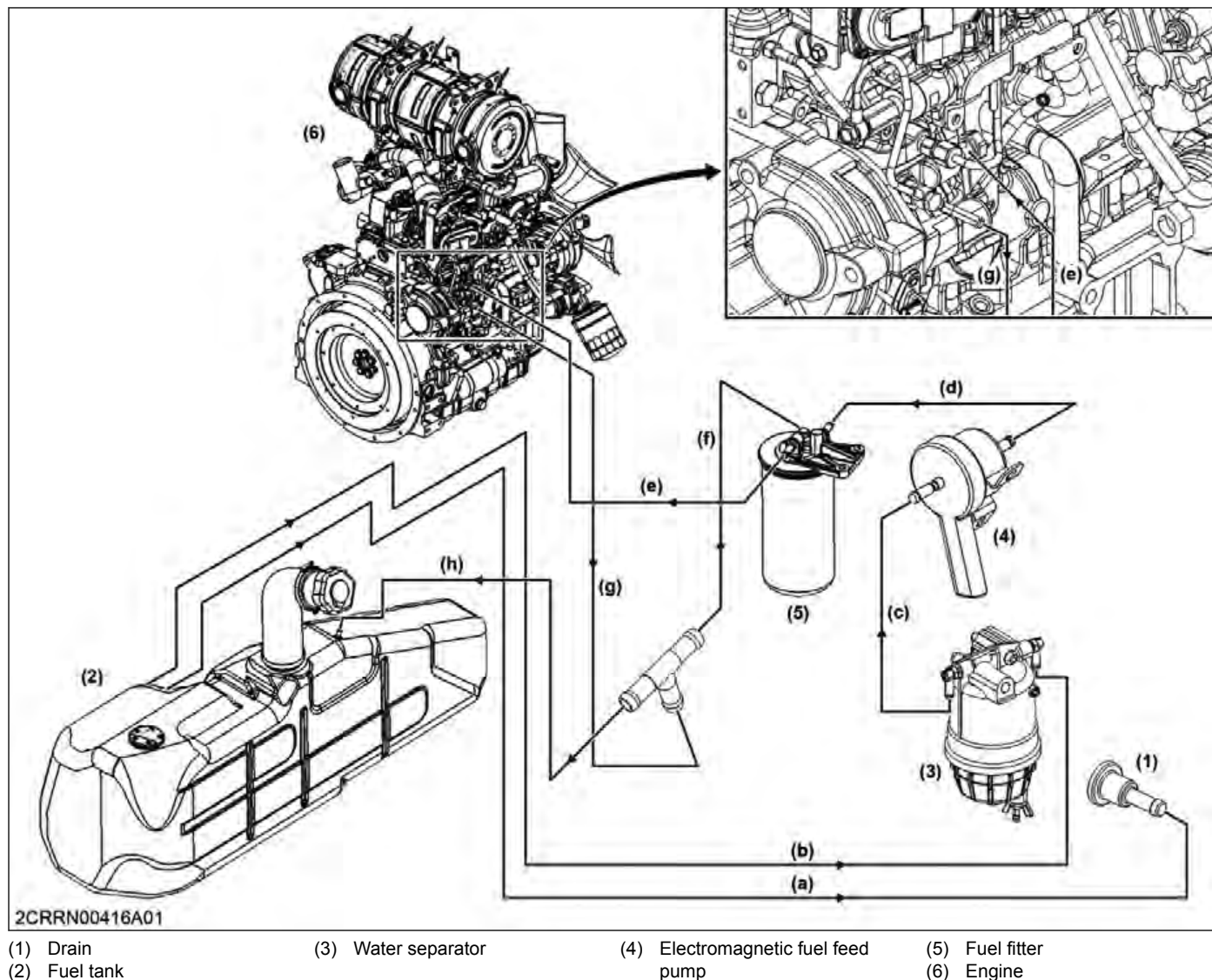
(29) Hose clamp	2.9 to 3.9 N · m 0.3 to 0.4 kgf · m 2.1 to 2.9 lbf · ft
(31) Screw	3 to 4 N · m 0.3 to 0.4 kgf · m 2 to 3 lbf · ft

4.1.2 Fuel hose routing



CAUTION

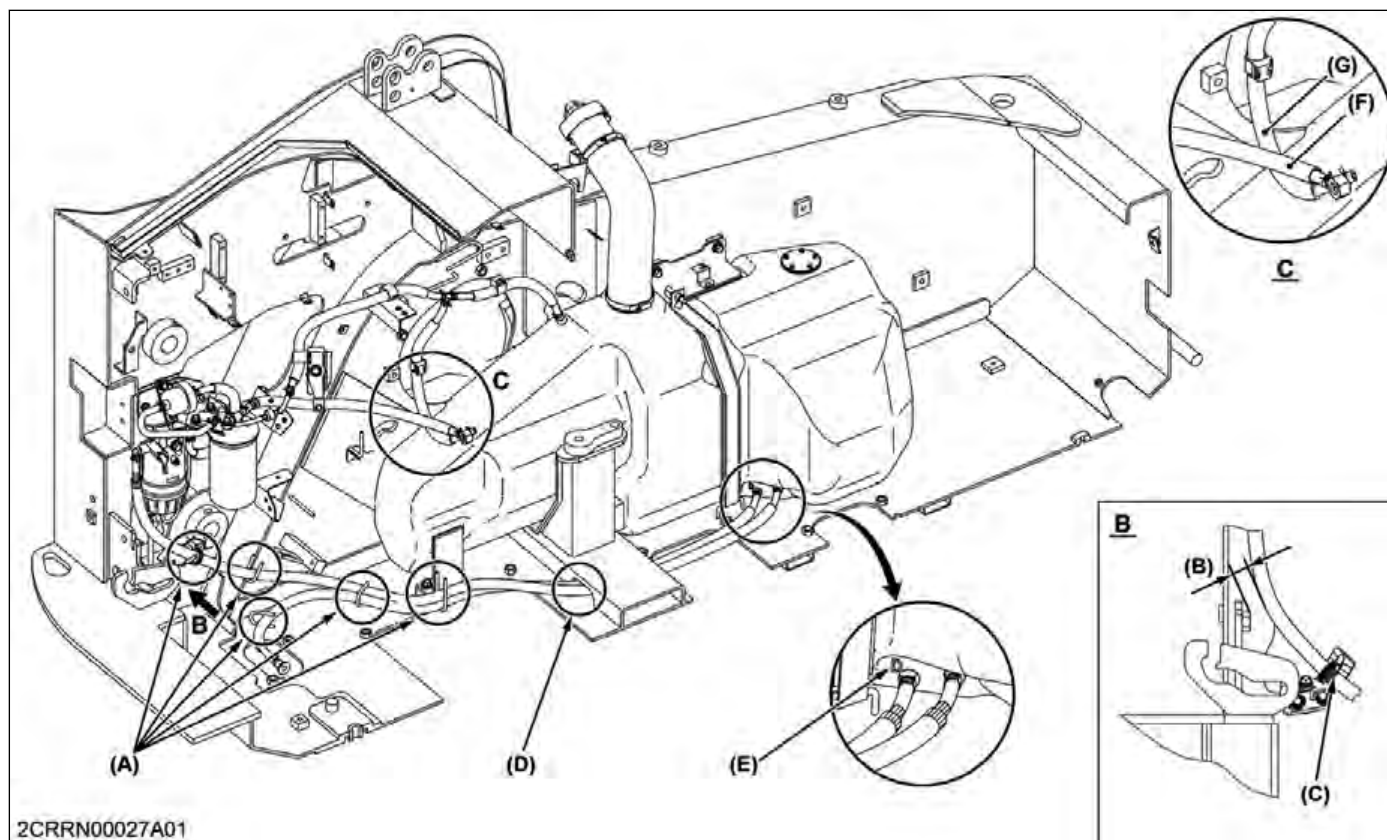
- Do not make the fuel hoses contact sharp edges, high temperature parts, or rotating parts.
- Do not stretch the fuel hoses excessively.
- Do not clamp the fuel hoses with electrical wiring.
- Do not flatten the fuel hoses with clamps.



	Point of use	Hose	Protection tube		Inner diameter
		Length	Inner diameter	Length	
(a)	Drain - Fuel tank	1300 mm 51.2 in.	φ7.3 mm φ0.29 in.	1180 mm 46.5 in.	15.2 mm 0.60 in.
(b)	Fuel tank - Water separator	1700 mm 66.9 in.	φ7.3 mm φ0.29 in.	1580 mm 62.2 in.	15.2 mm 0.60 in.
(c)	Water separator - Electromagnetic fuel feed pump	360 mm 14.2 in.	φ7.3 mm φ0.29 in.	250 mm 9.84 in.	15.2 mm 0.60 in.

(Continued)

	Point of use	Hose	Protection tube		Inner diameter
		Length	Inner diameter	Length	
(d)	Electromagnetic fuel feed pump - Fuel fitter	Molded hose	φ7.3 mm φ0.29 in.	—	—
(e)	Fuel fitter - Engine	510 mm 20.1 in.	φ7.3 mm φ0.29 in.	410 mm 16.1 in.	15.2 mm 0.60 in.
(f)	Fuel fitter - Relay	385 mm 15.2 in.	φ7.3 mm φ0.29 in.	305 mm 12.0 in.	15.2 mm 0.60 in.
(g)	Engine - Relay	420 mm 16.5 in.	φ7.3 mm φ0.29 in.	320 mm 12.6 in.	15.2 mm 0.60 in.
(h)	Relay - Fuel tank	330 mm 13.0 in.	φ7.3 mm φ0.29 in.	230 mm 9.06 in.	15.2 mm 0.60 in.



- (A): Pass through the hose guides (fuel tank to water separator).
- (B): Leave a gap between the fuel hose and sharp edge more than 15 mm (fuel tank to water separator).
- (C): Clamp the hose at the white tape position (fuel tank to water separator).
- (D): Pass through the frame parts (fuel tank to water separator, fuel tank drain hose).
- (E): Connect to the fuel tank that marked with D (fuel tank drain hose).
- (F): Connect to the engine (fuel filter to engine).
- (G): Connect to the engine (engine to T-fitting of fuel fitter).

4.2 Engine

4.2.1 Removing and installing engine

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Do not install the fuel hose as below.
 - Making it contact sharp edges, high temperature parts, or rotating parts.
 - Stretching excessively, deforming, or clamping with electrical wiring.
- Keep fire and flammable items away from the working area.

IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.
- Install plugs or covers to the removed fuel hoses, radiator hoses, and air conditioning hoses to avoid dust contamination.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Jack up the machine.
3. Open the rear bonnet and insert the pin into the lock position.

CAUTION

- Check that the rear bonnet is securely locked.

4. Disconnect the battery cable from negative (-) terminal.
5. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
6. Remove the radiator and oil cooler.
7. Vacuum the refrigerant from the cooling circuit.
8. Remove the upper bonnet.
9. Remove the DPF muffler.
10. Tilt up the cab.
11. Remove the HST pump.

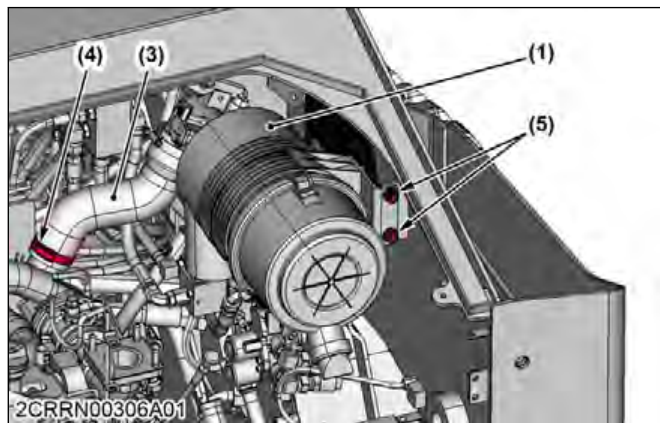
Removing

1. Disconnect the AFS connector.



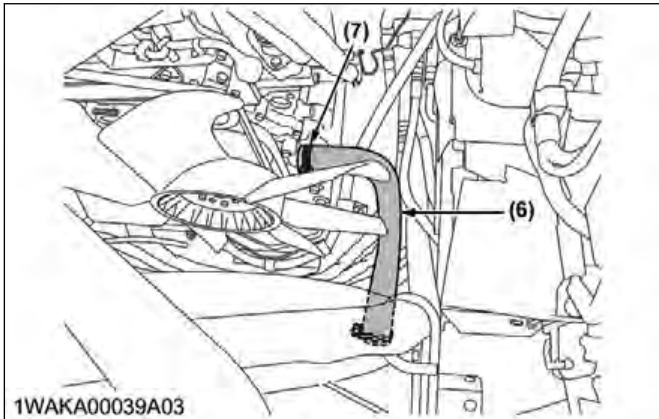
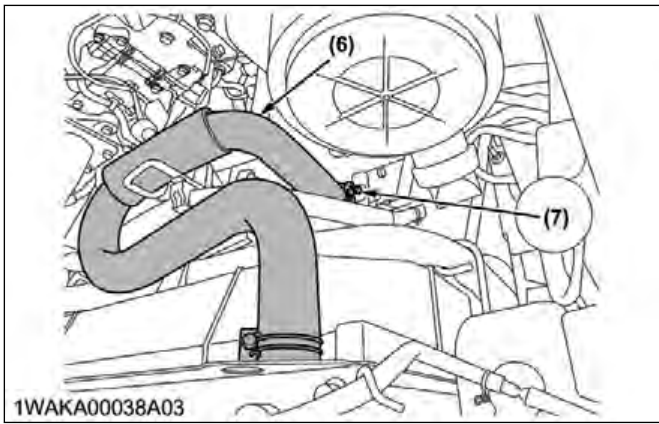
- (1) Air cleaner (2) AFS connector

2. Remove the hose clamp to remove the hose from the engine.
3. Remove the 2 bolts to remove the air cleaner and the hose.



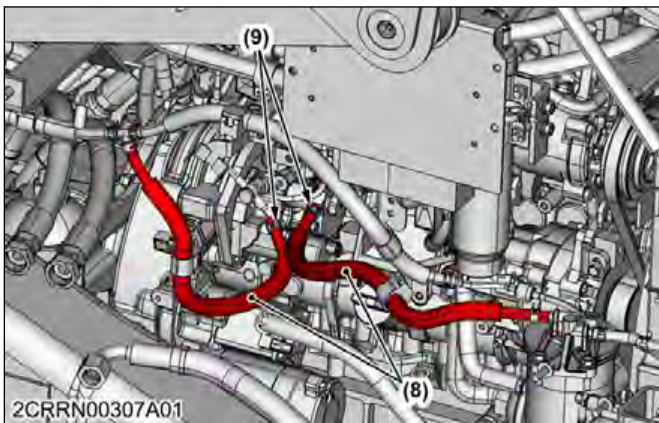
- (1) Air cleaner (3) Hose (4) Hose clamp (5) Bolt (M10 × 25) ×2

4. Remove the 2 hose clamps to remove the 2 radiator hoses.



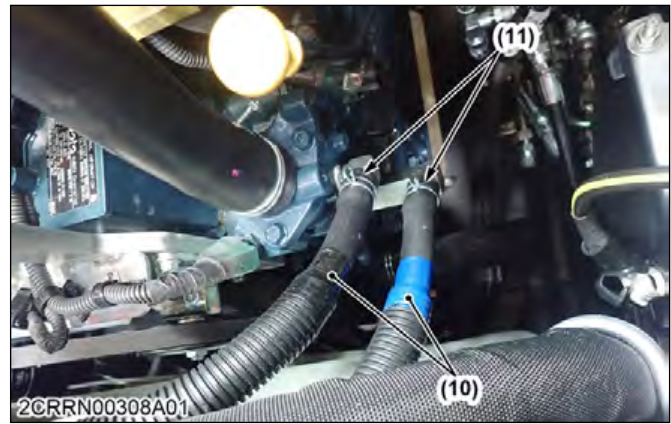
(6) Radiator hose ×2 (7) Hose clamp ×2

5. Remove the 2 hose clamps and the 2 fuel hoses.



(8) Fuel hose ×2 (9) Hose clamp ×2

6. Remove the 2 hose clamps and the 2 heater hoses.



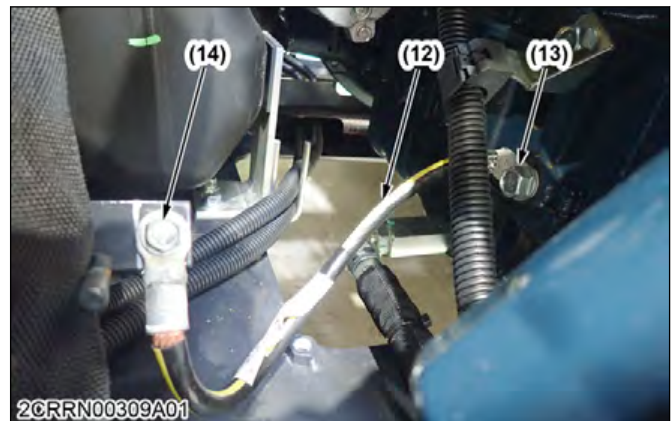
(10) Heater hose ×2 (11) Hose clamp ×2

7. Disconnect all connectors of the engine.

8. Remove the 2 bolts to disconnect the ground cable.

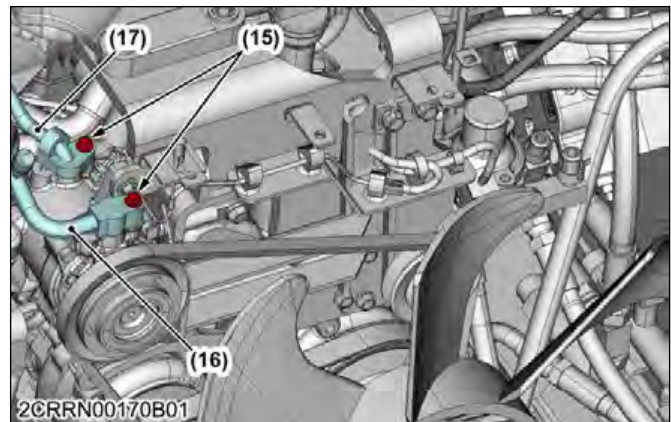
NOTE

- Remove the ground bolt.



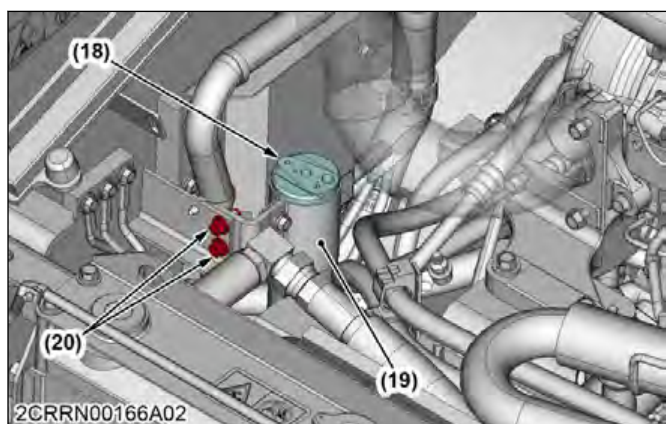
(12) Ground cable (13) Bolt (M12 × 20) (14) Ground bolt (M8 × 16)

9. Remove the 2 bolts, and disconnect the suction hose and discharging hose.



(15) Bolt (M6 × 25) ×2 (16) Suction hose (17) Discharging hose

10. Remove the 2 bolts, receiver holder, and receiver.



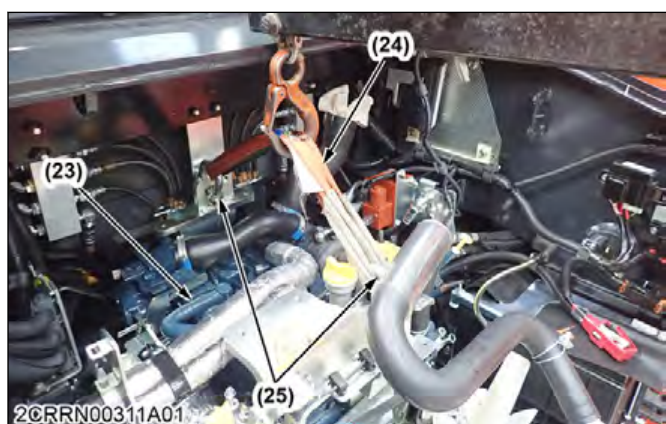
(18) Receiver
(19) Receive holder
(20) Bolt (M8 x 25) x2

11. Remove the 2 bolts to remove the stay.



(21) Stay
(22) Bolt (M8 x 16) x2

12. Attach a nylon sling with 2 shackles and hoist for support.



(23) Engine
(24) Nylon sling
(25) Shackle x2

13. Remove the 4 bolts to remove the fan.



(26) Fan
(27) Bolt (M8 x 12) x4

14. Remove the 4 bolts to remove the engine bracket.



(28) Engine bracket
(29) Bolt (M12 x 75) x4

15. Remove the nut, the stud bolt and the 2 mounting rubbers.



(30) Nut
(31) Stud bolt
(32) Mounting rubber x2

16. Remove the 4 bolts to remove the hose stay.



(33) Hose stay

(34) Bolt (M10 × 20) × 4

17. Remove the 2 nuts, the 2 stud bolts, the 2 collars and the 4 mounting rubbers.



(30) Nut × 2

(35) Bolt × 2

(31) Stud bolt × 2

(36) Collar × 2

(32) Mounting rubber × 4

18. Remove the engine.

Mass

Engine	Approximately 316 kg Approximately 697 lbs
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Installing

Tightening torque

(4) Hose clamp	4.9 to 5.9 N·m 0.50 to 0.60 kgf·m 3.7 to 4.3 lbf·ft	—
(7) Hose clamp	2.5 to 3.4 N·m 0.25 to 0.35 kgf·m 1.9 to 2.5 lbf·ft	—
(29) Bolt	77.5 to 90.2 N·m 7.9 to 9.2 kgf·m 57.2 to 66.5 lbf·ft	Thread lock (Loctite 263)
(30) Nut	196.1 to 225.6 N·m 20 to 23 kgf·m 144.7 to 166.3 lbf·ft	—
(31) Stud bolt	98 to 113 N·m 10.0 to 11.5 kgf·m 73.0 to 83.3 lbf·ft	Thread lock (Loctite 263)
(35) Bolt	196.1 to 225.6 N·m 20 to 23 kgf·m 144.7 to 166.3 lbf·ft	Thread lock (Loctite 263)

4.2.2 Removing and installing the alternator

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



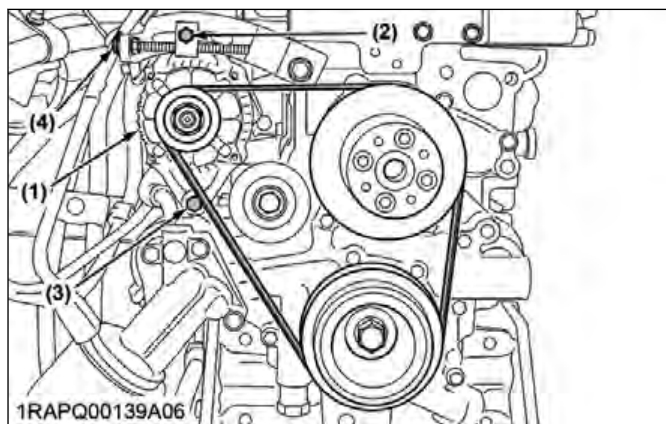
CAUTION

- Check that the rear bonnet is securely locked.

3. Disconnect the negative (-) terminal from the battery.
4. Remove the fan.
5. Loosen and remove the air conditioning belt.
6. Loosen the fan belt.
7. Tilt the radiator and oil cooler.

Removing

1. Disconnect all of the wire harnesses from the alternator.
2. Remove the 2 bolts and loosen the adjuster bolt.



- (1) Alternator
(2) Bolt (M8 × 50)
(3) Bolt (M10 × 80)
(4) Adjuster bolt

3. Remove the alternator.

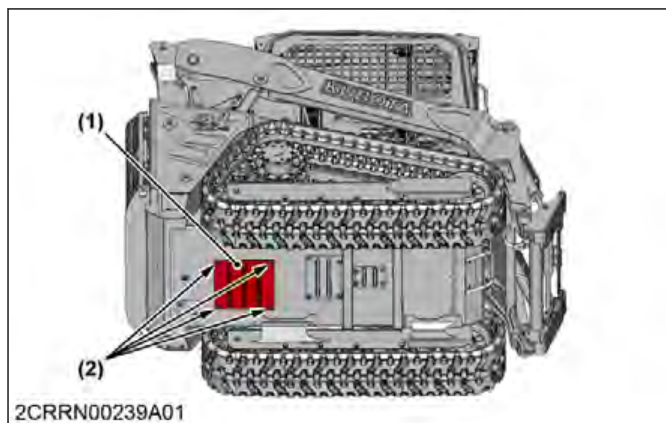
Mass

Alternator	Approximately 4.5 kg Approximately 9.9 lbs
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4.2.3 Removing and installing the starter motor

Preparing

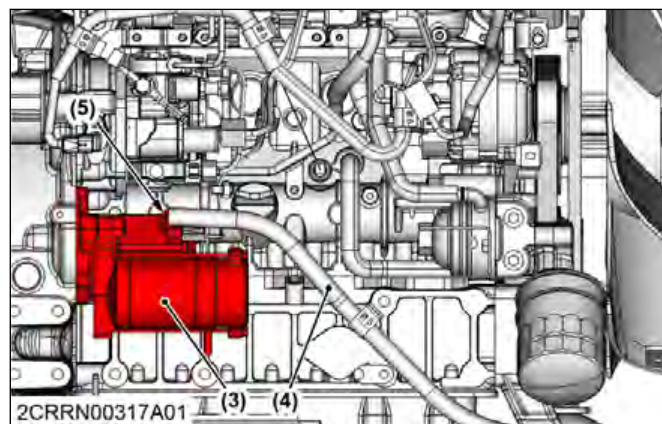
1. Lower the front attachment to the ground, and stop the engine.
2. Jack up the machine.
3. Disconnect the negative (-) terminal from the battery.
4. Tilt the radiator and oil cooler.
5. Remove the 4 bolts to remove the cover.



- (1) Cover
(2) Bolt (M12 × 30) × 4

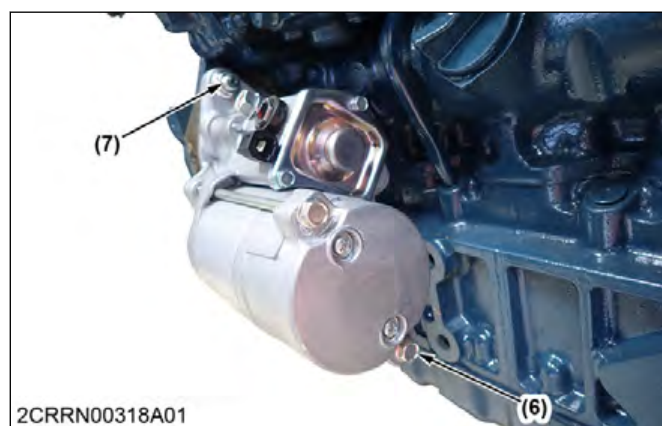
Removing

1. Disconnect all of the connectors from the starter motor.
2. Remove the nut to remove the ground cable.



- (3) Starter motor
(4) Ground cable
(5) Nut

3. Remove the bolt and nut.



- (6) Bolt (M10 × 35)
(7) Nut

4. Remove the starter motor.

Mass

Starter motor	Approximately 4.6 kg Approximately 10 lbs
---------------	--

Installing

Tightening torque

(5) Nut	9.8 to 11 N · m 1.0 to 1.2 kgf · m 7.3 to 8.6 lbf · ft	—
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4.2.4 Removing and installing the injector

CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

IMPORTANT

- Work at clean work space with clean tools and lubricant to avoid dust contamination.

- Install plugs or covers to the removed fuel hoses, radiator hoses, and air conditioning hoses to avoid dust contamination.
- Do not reuse the used gasket of the injector.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

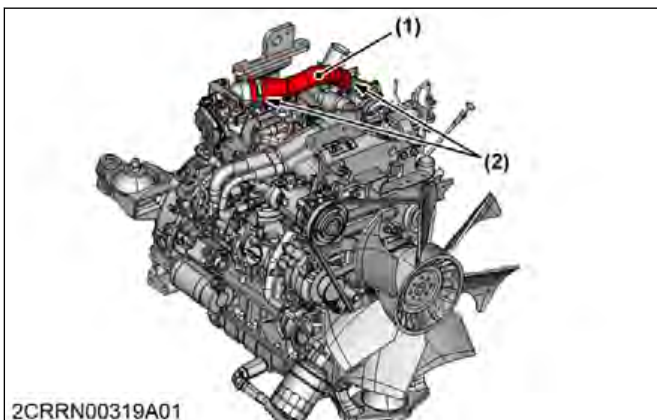
**CAUTION**

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
5. Open the upper bonnet.
6. Tilt the radiator and oil cooler.
7. Vacuum the refrigerant from the cooling circuit.
8. Remove the upper bonnet.
9. Remove the receiver.
10. Remove the DPF muffler.

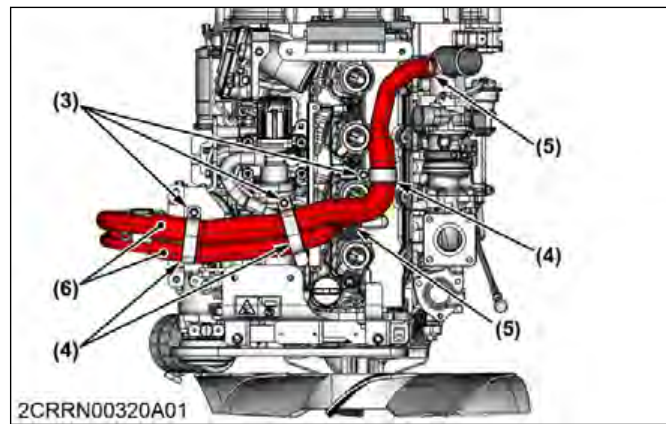
Removing

1. Remove the 2 hose clamps to remove the intake air hose.



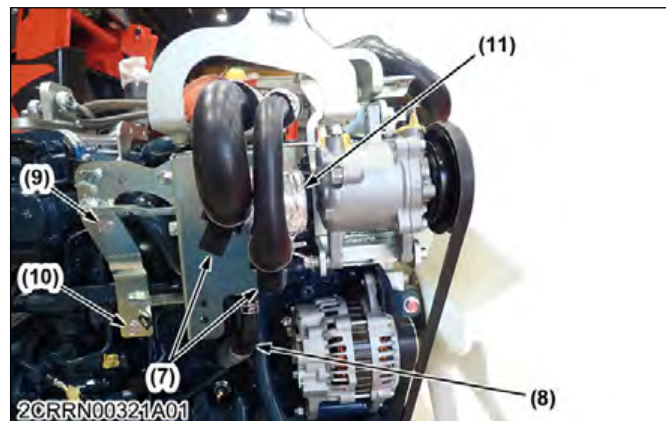
- (1) Intake air hose (2) Hose clamp ×2

2. Remove the 3 bolts to remove the 3 hose clamps.
3. Remove the 2 heater hoses on the engine side.



- (3) Bolt (M6 × 12) ×3 (6) Heater hose ×2
(4) Hose clamp ×3
(5) Hose clamp ×2

4. Disconnect the 2 connectors and hose from the oil separator.
5. Remove the 2 bolts to remove the oil separator.



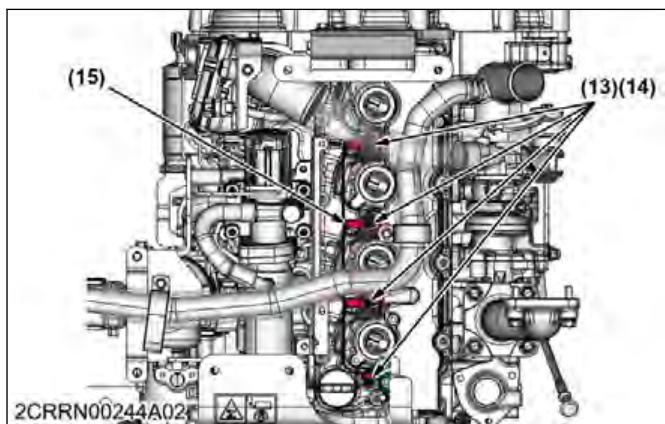
- (7) Connector ×2 (10) Bolt (M8 × 60)
(8) Hose (11) Oil separator
(9) Bolt (M8 × 50)

6. Remove the 4 connectors from the injectors.



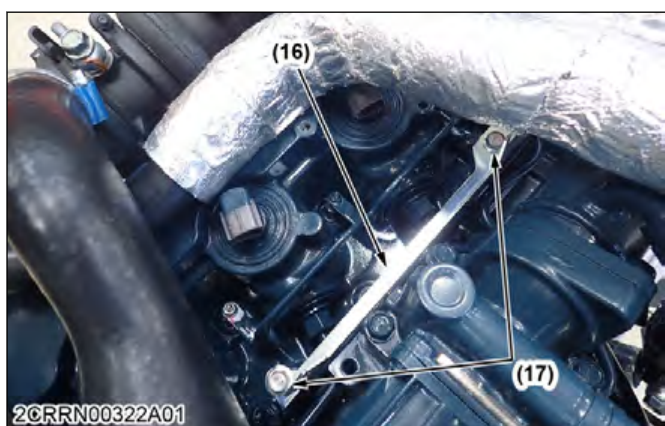
- (12) Connector ×4

7. Remove the 4 nuts and glow lead to remove the 4 glow plugs.



(13) Nut ×4
(14) Glow plug ×4
(15) Glow lead

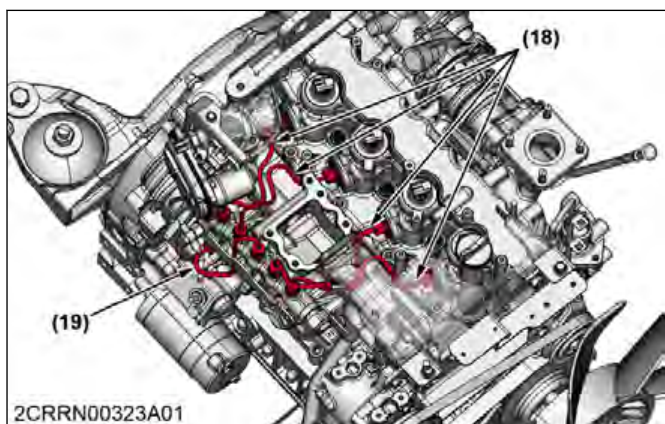
8. Remove the 2 nuts to remove the stay.



(16) Stay
(17) Nut ×2

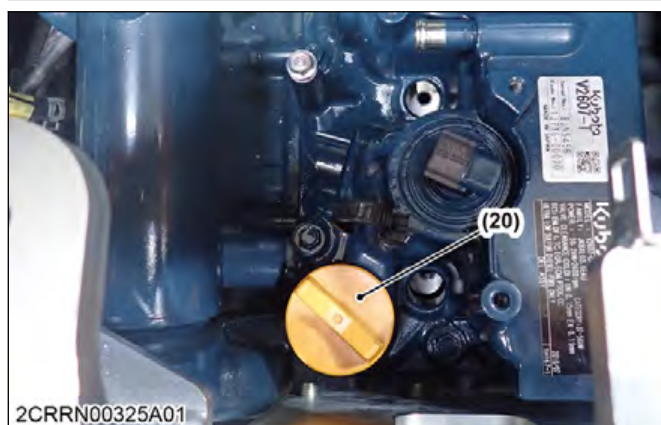
9. Remove the EGR valve.

10. Remove the 5 injection pipes.



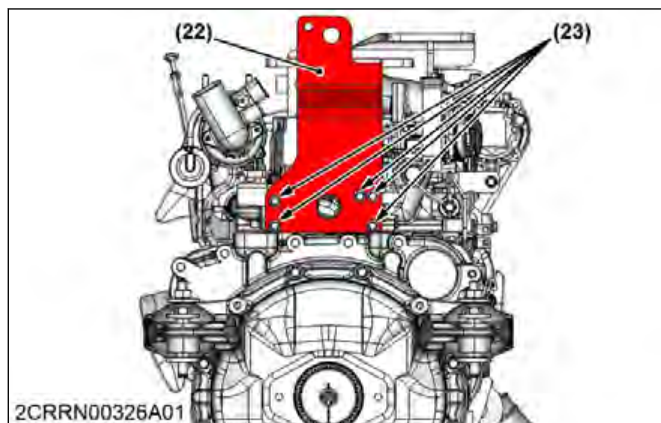
(18) Injection pipe ×4
(19) Injection pipe

11. Remove the flange and install the plug to the engine.



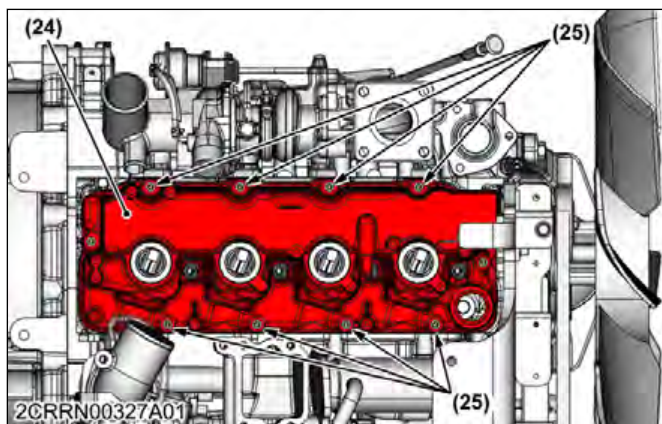
(20) Plug
(21) Flange

12. Remove the 5 bolts to remove the stay.



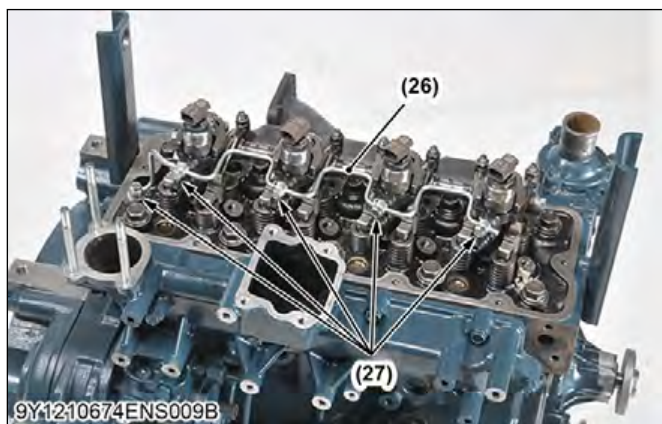
(22) Stay
(23) Bolt (M8 × 20) ×5

13. Remove the 10 bolts to remove the cylinder head cover.



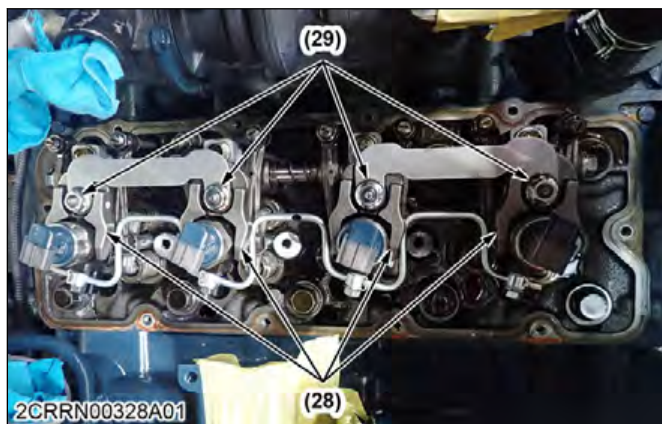
(24) Cylinder head cover (25) Bolt (M10 × 22) × 10

14. Remove the 5 bolts to remove the overflow pipe.



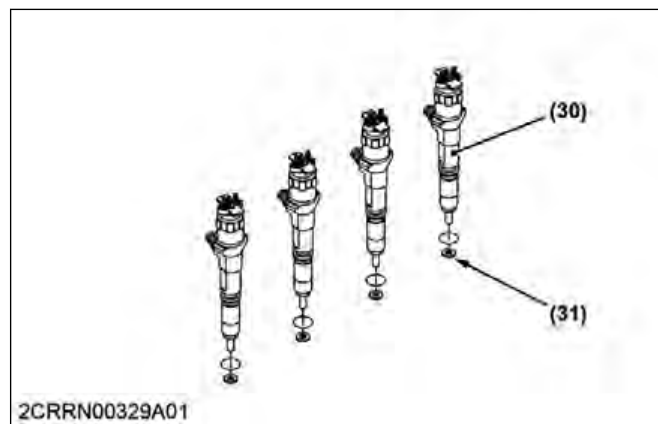
(26) Overflow pipe (27) Bolt (M8 × 10) × 5

15. Remove the 4 nuts to remove the 4 injector clamps.



(28) Injector clamp × 4 (29) Nut × 4

16. Remove the 4 injectors and 4 gaskets.



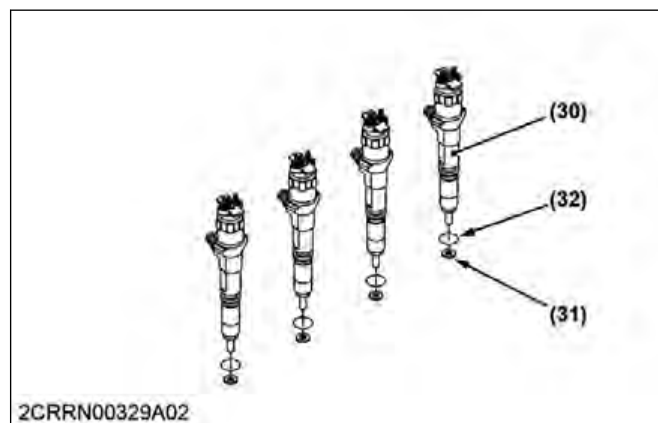
(30) Injector × 4 (31) Gasket × 4

Installing

1. Replace the gasket of the injector with a new one.
2. Install the 4 injectors, 4 gaskets and 4 O-rings.

■ IMPORTANT

- Apply engine oil to the O-ring surface when installing.
- Do not reuse the gasket.

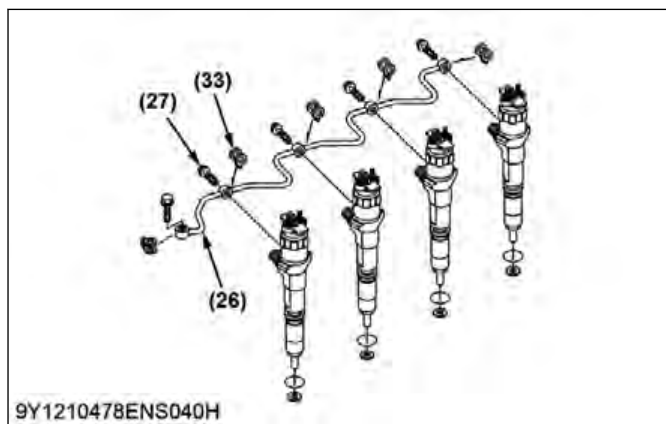


(30) Injector × 4 (31) Gasket × 4 (32) O-ring × 4

3. Install the 5 bolts and 5 gaskets to install the overflow pipe.

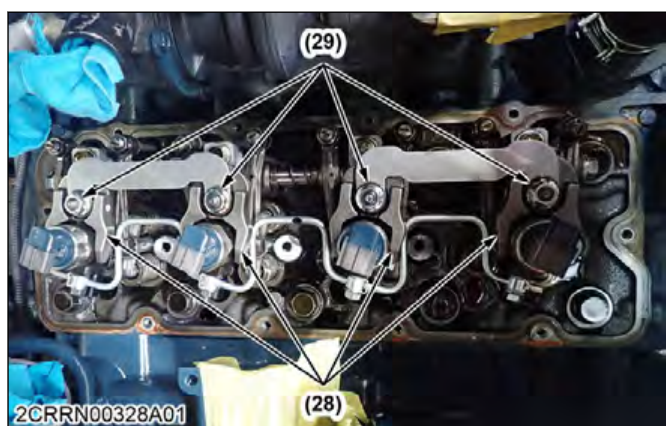
■ IMPORTANT

- After installing the overflow pipe, add pressure by air from the fuel pipe joint, and check for fuel leakage of overflow pipe and gasket.
- In the case of fuel leakage, replace the gasket, then check fuel leakage again.



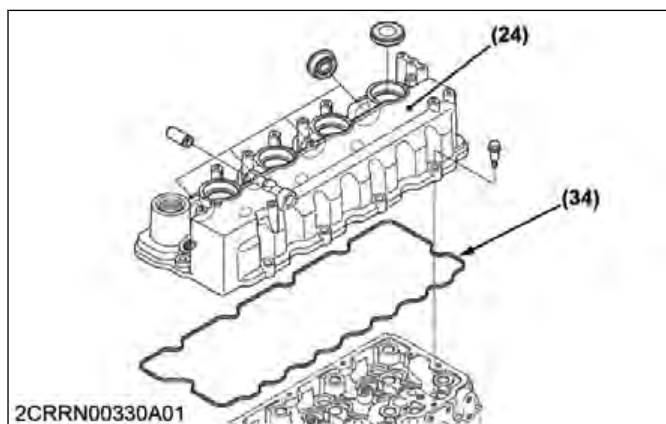
(26) Overflow pipe
(27) Bolt (M8 × 10) ×5
(33) Gasket ×5

4. Install the 4 nuts to install the 4 injector clamps.



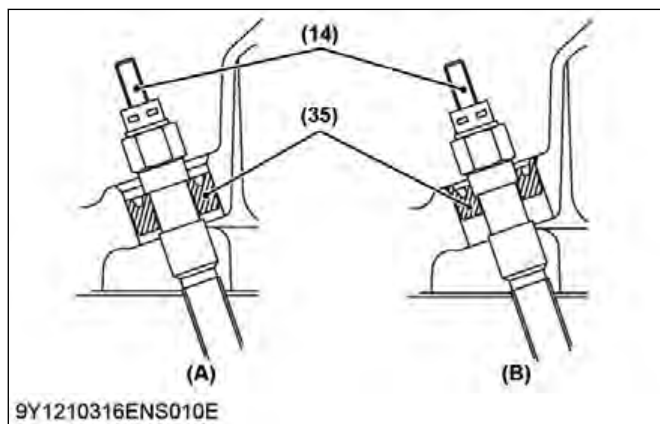
(28) Injector clamp ×4
(29) Nut ×4

5. Replace the gasket of the cylinder head cover with a new one.



(24) Cylinder head cover
(34) Gasket

6. Install the cylinder head cover.
7. Install the seal so that the ditch on it faces the terminal side.
8. After installing the glow plug, make sure that the seal is set to the specified position.



(14) Glow plug
(35) Seal
(A) Good
(B) Bad

■ IMPORTANT

- When replacing the injector with a new one, perform “Injector Compensation” on the Diagmaster and sign up the new code to the K-ISS.

Tightening torque

(13) Nut	0.98 to 1.70 N·m 0.10 to 0.18 kgf·m 0.73 to 1.30 lbf·ft
(14) Glow plug	7.7 to 9.3 N·m 0.78 to 0.95 kgf·m 5.7 to 6.8 lbf·ft
(18) Injection pipe	30 to 40 N·m 3.1 to 4.0 kgf·m 23 to 29 lbf·ft
(19) Injection pipe	30 to 40 N·m 3.1 to 4.0 kgf·m 23 to 29 lbf·ft
(25) Bolt	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
(27) Bolt	9.81 to 11.2 N·m 1.00 to 1.15 kgf·m 7.24 to 8.31 lbf·ft
(29) Nut	24 to 27 N·m 2.4 to 2.8 kgf·m 18 to 20 lbf·ft

4.2.5 Removing and installing the turbocharger

⚠ CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Do not install the fuel hose as below.
 - Making it contact sharp edges, high temperature parts, or rotating parts.

- Stretching excessively, deforming, or clamping with electrical wiring.
- Keep fire and flammable items away from the working area.

IMPORTANT

- Install plugs to removed adapters to avoid oil leakage and dust contamination.
- Install plugs or covers to the removed fuel hoses, radiator hoses, intake air line, and air conditioning hoses to avoid dust contamination.
- Do not reuse the used gasket of the turbocharger and the exhaust manifold.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.

**CAUTION**

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Remove the upper bonnet.
5. Remove the DPF muffler.

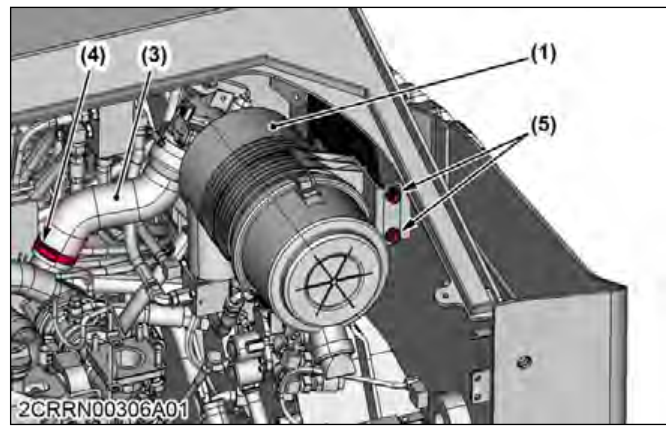
Removing

1. Disconnect the AFS connector.



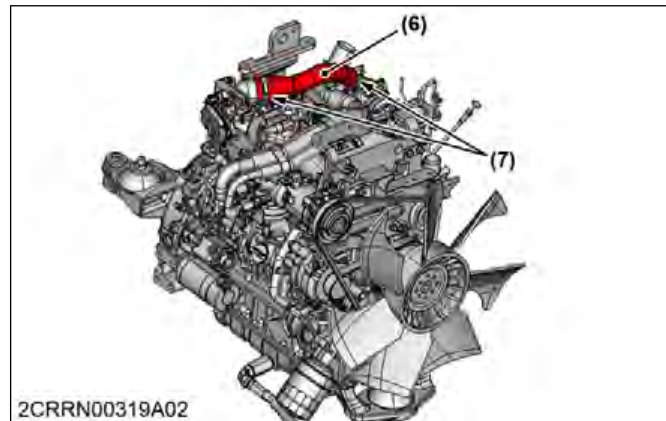
(1) Air cleaner (2) AFS

2. Remove the hose clamp to remove the hose from the engine.
3. Remove the 2 bolts to remove the air cleaner and the hose.



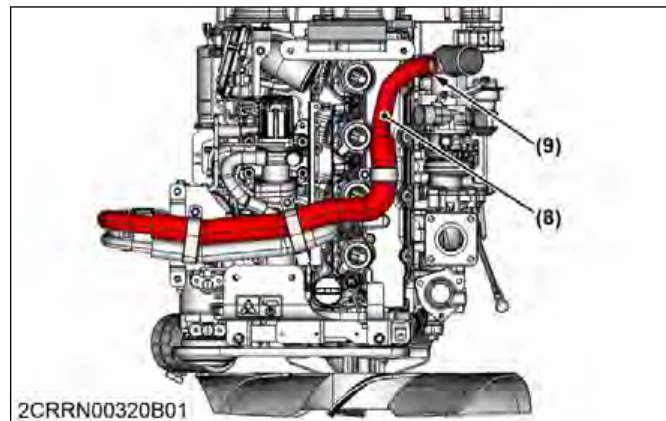
(1) Air cleaner (5) Bolt (M10 × 25) × 2
(3) Hose
(4) Hose clamp

4. Remove the 2 hose clamps to remove the intake air hose.



(6) Intake air hose (7) Hose clamp × 2

5. Remove the hose clamp and heater hoses.



(8) Heater hose (9) Hose clamp

6. Remove the bolt to remove the oil pipe of the turbocharger side.



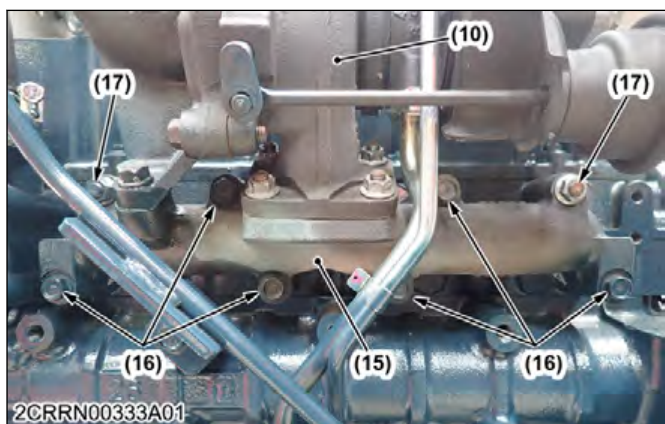
(10) Turbocharger
(11) Oil pipe
(12) Bolt (M10 × 24)

7. Remove the hose clamp to remove the oil pipe.



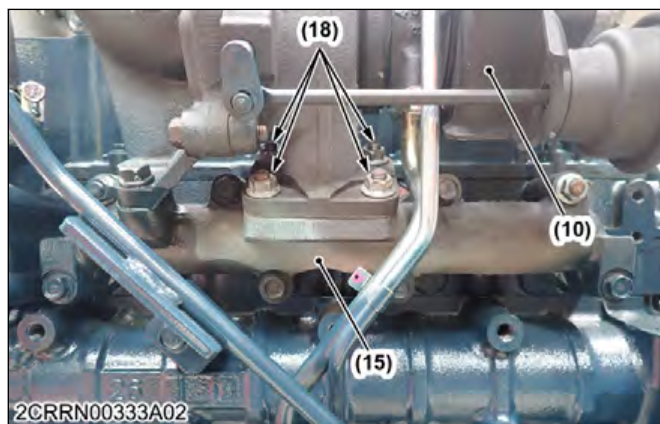
(13) Oil pipe
(14) Hose clamp

8. Remove the 6 bolts and 2 nuts to remove the exhaust manifold and the turbocharger.



(10) Turbocharger
(15) Exhaust manifold
(16) Bolt (M10 × 10) × 6
(17) Nut × 2

9. Remove the 4 nuts to remove the turbocharger.



(10) Turbocharger
(15) Exhaust manifold
(18) Nut × 4

Mass

Exhaust manifold	Approximately 3.2 kg Approximately 7.0 lbs
Turbocharger	Approximately 6.0 kg Approximately 13.0 lbs
Total	Approximately 9.2 kg Approximately 20 lbs

Installing

Tightening torque

(17) Nut	30 to 34 N · m 3.0 to 3.5 kgf · m 22 to 25 lbf · ft
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4.2.6 Removing and installing the EGR valve



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.



IMPORTANT

- Install plugs or covers to the removed EGR cooler hoses and heater hoses to avoid oil leakage and dust contamination.
- Do not reuse the used gasket of the EGR valve.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

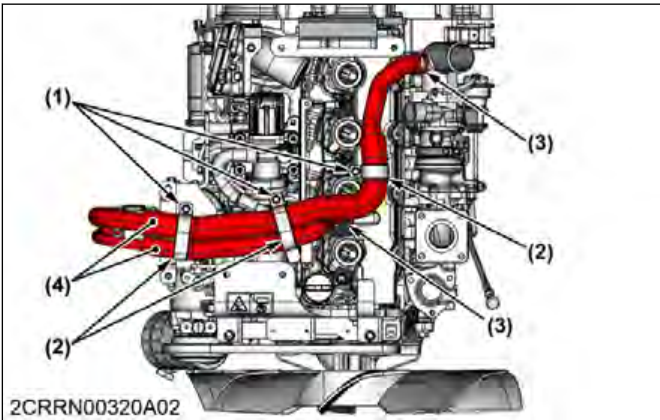
CAUTION

- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from negative (-) terminal.
4. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
5. Tilt the radiator and oil cooler.
6. Remove the upper bonnet.
7. Remove the receiver.
8. Remove the DPF muffler.

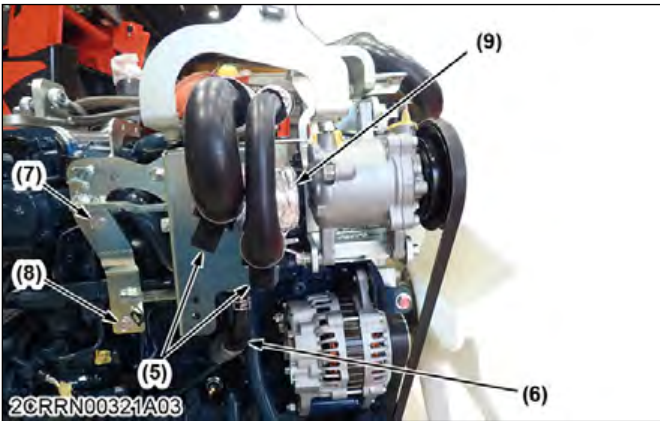
Removing

1. Remove the 3 bolts to remove the 3 hose clamps.
2. Remove the 2 heater hoses on the engine side.



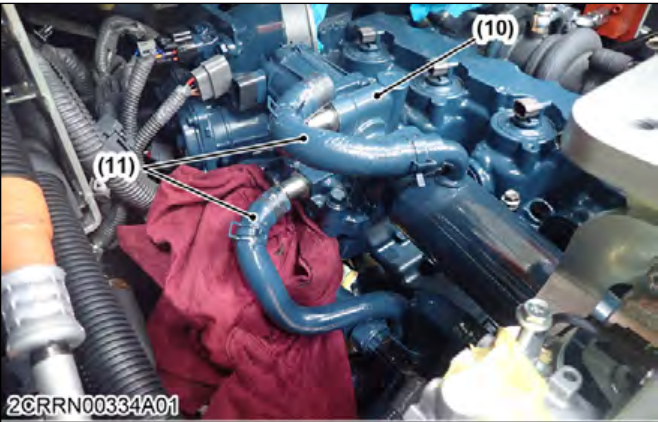
- (1) Bolt (M6 × 12) × 3 (4) Heater hose × 2
(2) Hose clamp × 3
(3) Hose clamp × 2

3. Disconnect the 2 connectors and hose from the oil separator.
4. Remove the 2 bolts to remove the oil separator.



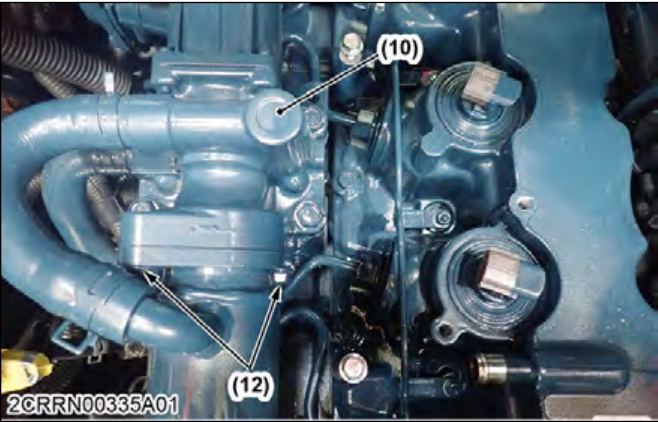
- (5) Connector × 2 (8) Bolt (M8 × 60) × 2
(6) Hose (9) Oil separator
(7) Bolt (M8 × 50) × 2

5. Remove the 2 cooler hoses from the EGR valve.



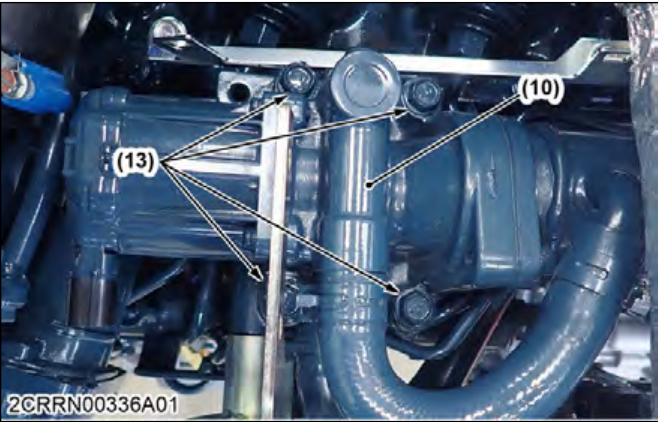
- (10) EGR valve (11) Cooler hose × 2

6. Remove the 2 bolts.



- (10) EGR valve (12) Bolt (M10 × 35) × 2

7. Remove the 4 bolts to remove the EGR valve.



- (10) EGR valve (13) Bolt (M10 × 35) × 4

Mass

EGR valve	Approximately 1.4 kg Approximately 3.1 lbs
-----------	---

4.2.7 Removing and installing the EGR cooler



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

IMPORTANT

- Install plugs or covers to the removed EGR cooler hoses and heater hoses to avoid oil leakage and dust contamination.
- Do not reuse the used gaskets of the EGR cooler.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.



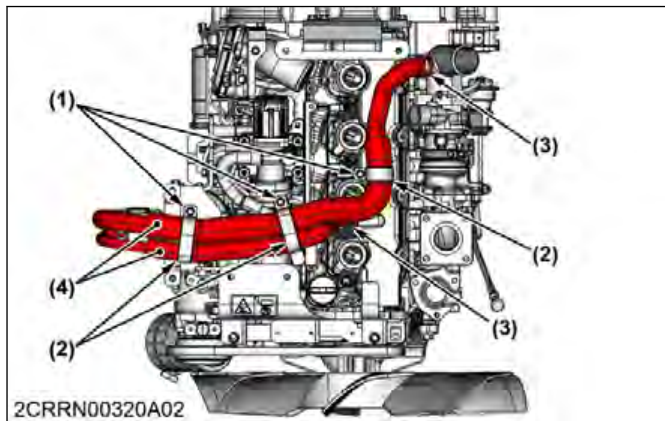
CAUTION

- Check that the rear bonnet is securely locked.

- Disconnect the battery cable from negative (-) terminal.
- Install a vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
- Tilt the radiator and oil cooler.
- Remove the upper bonnet.
- Remove the receiver.
- Remove the DPF muffler.

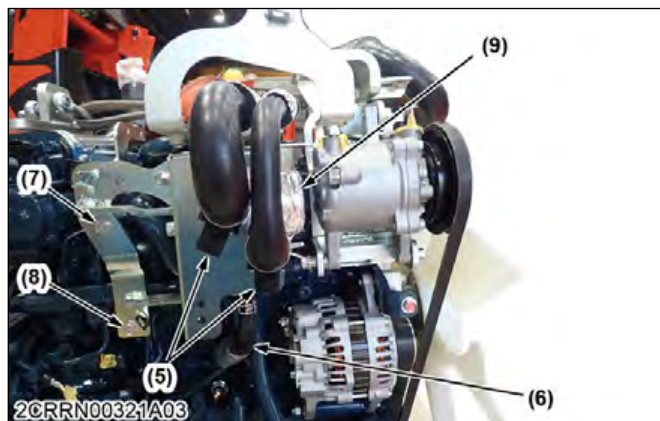
Removing

- Remove the 3 bolts to remove the 3 hose clamps.
- Remove the 2 hose clamps to remove the 2 heater hoses on the engine side.



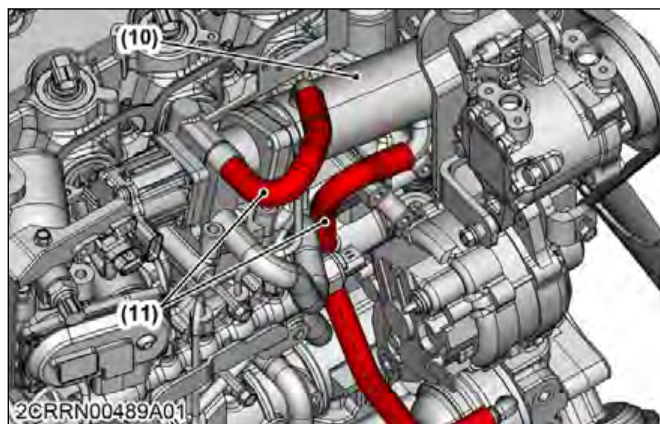
- (1) Bolt (M6 × 12) ×3
(2) Hose clamp ×3
(3) Hose clamp ×2
(4) Heater hose ×2

- Disconnect the 2 connectors and hose from the oil separator.
- Remove the 2 bolts to remove the oil separator.



- (5) Connector ×2
(6) Hose
(7) Bolt (M8 × 50)
(8) Bolt (M8 × 60)
(9) Oil separator

- Remove the 2 cooler hoses from the EGR cooler.



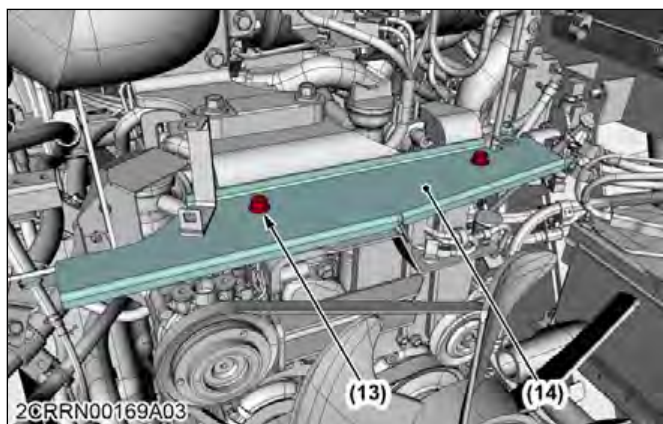
- (10) EGR cooler
(11) Cooler hose ×2

- Remove the 2 bolts.



- (10) EGR cooler
(12) Bolt (M10 × 35) ×2

- Remove the 2 bolts, and remove the cover.

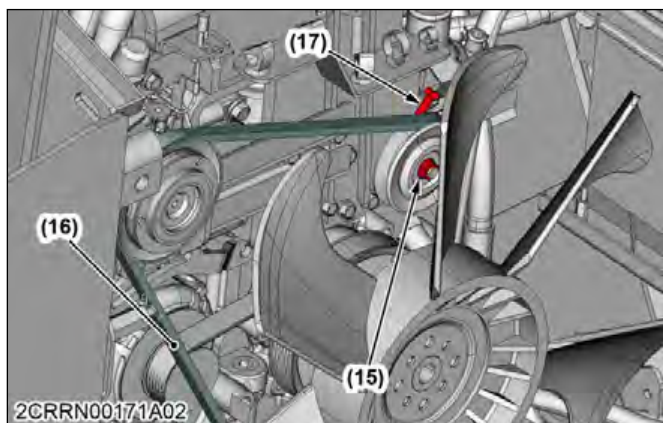


(13) Bolt (M8 × 20) × 2

(14) Cover

8. Loosen the locknut.

9. Loosen the tension bolt and remove the air conditioning belt.

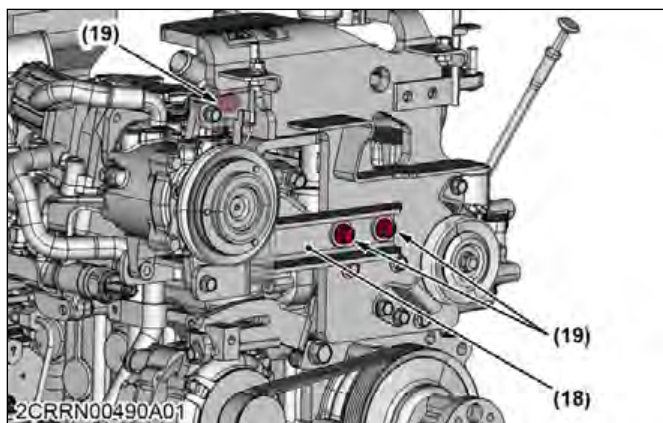


(15) Locknut

(17) Tension bolt

(16) Air conditioning belt

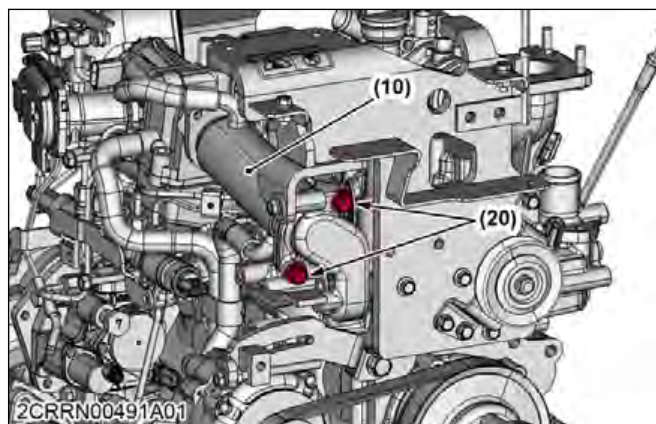
10. Remove the 3 bolts to remove the compressor stay.



(18) Compressor stay

(19) Bolt (M10 × 25) × 3

11. Remove the 2 bolts to remove the EGR cooler.



(10) EGR cooler

(20) Bolt (M10 × 35) × 2

Installing

Tightening torque

(15) Locknut	37.0 to 41.0 N · m 3.8 to 4.2 kgf · m 27.3 to 30.2 lbf · ft
--------------	---

4.2.8 Removing and installing the throttle valve



CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.



IMPORTANT

- Install plugs or covers to the removed intake air hose to avoid oil leakage and dust contamination.
- Do not reuse the used gasket of the throttle valve.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Open the rear bonnet and insert the pin into the lock position.



CAUTION

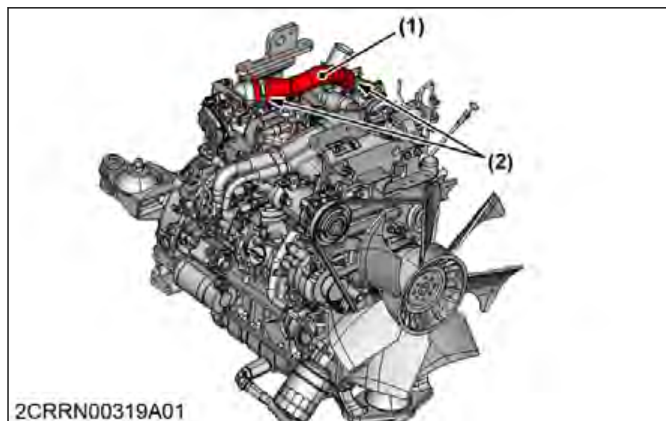
- Check that the rear bonnet is securely locked.

3. Disconnect the battery cable from the negative (-) terminal.
4. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
5. Tilt the radiator and oil cooler.
6. Vacuum the refrigerant from the cooling circuit.
7. Remove the upper bonnet.

8. Remove the receiver.
9. Remove the DPF muffler.
10. Tilt up the cab.

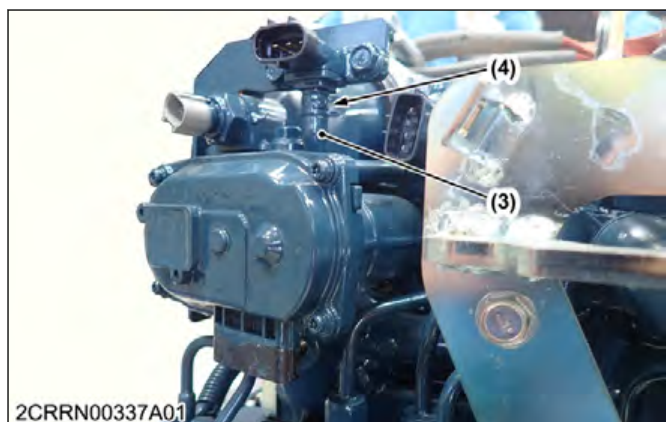
Removing

1. Remove the 2 hose clamps to remove the intake air hose.



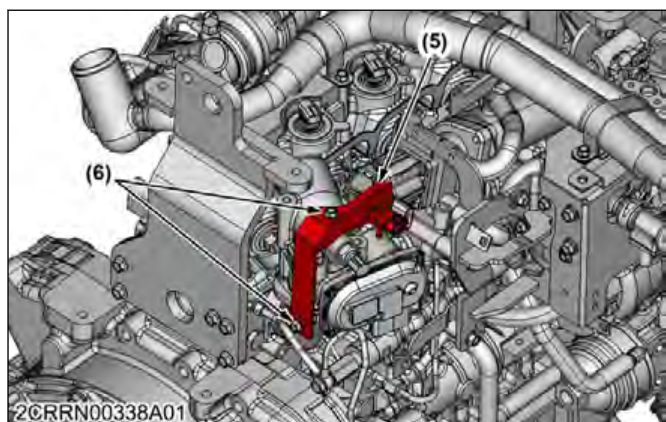
- (1) Intake air hose (2) Hose clamp ×2

2. Remove the hose clamp to remove the hose.



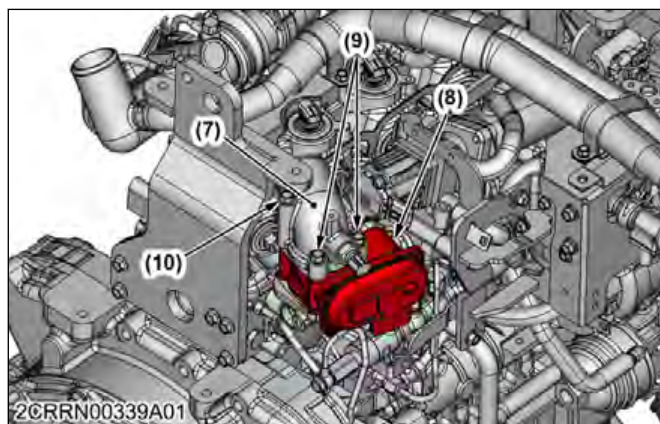
- (3) Hose (4) Hose clamp

3. Remove the 2 bolts to remove the cover.



- (5) Cover (6) Bolt (M6 × 12) ×2

4. Remove the 3 bolts to remove the flange and the throttle valve.



- (7) Flange (10) Bolt (M8 × 116)
(8) Throttle valve
(9) Bolt (M8 × 80) ×2

Mass

Throttle valve	Approximately 0.8 kg Approximately 2.0 lbs
----------------	---

4.3 Radiator

4.3.1 Removing and installing radiator and oil cooler

⚠ CAUTION

- Do not work soon after stopped the engine.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

■ IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Lower the front attachment to the ground, and stop the engine.
2. Install the vacuum pump to the hydraulic oil tank, and vacuum the hydraulic oil tank.
3. Open the rear bonnet and insert the pin into the lock position.

⚠ CAUTION

- Check that the rear bonnet is securely locked.

4. Open the upper bonnet.
5. Tilt the radiator and oil cooler.
6. Drain the coolant.

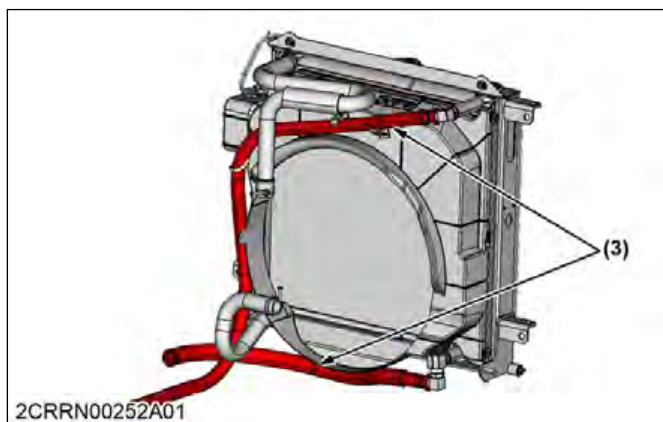
Removing

1. Remove the 2 bolts to remove the hose guide.



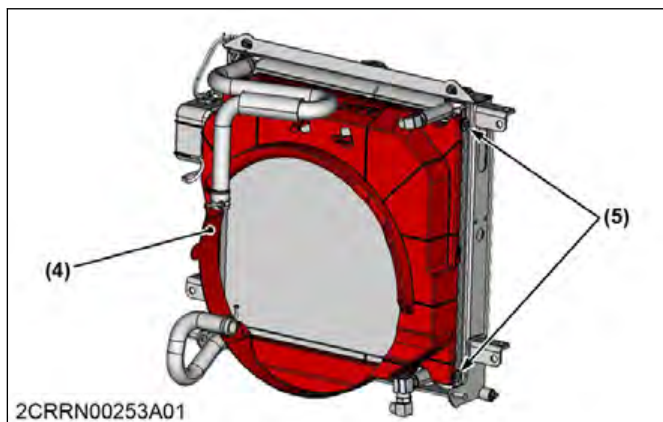
(1) Bolt (M8 × 25) × 2 (2) Hose guide

2. Remove the 2 hydraulic hoses.



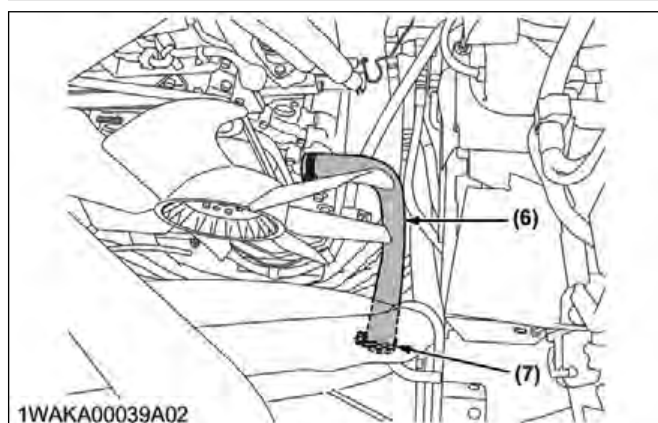
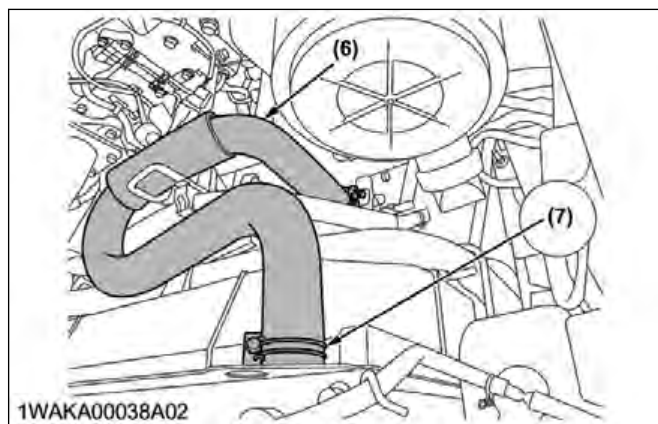
(3) Hydraulic hose × 2

3. Remove the 4 bolts to remove the fan shroud.



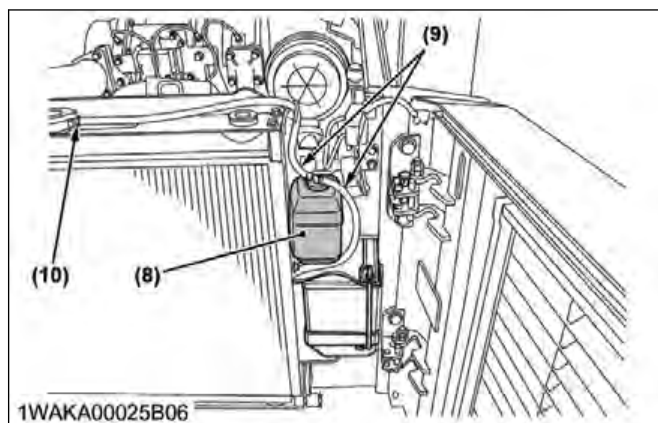
(4) Fan shroud (5) Bolt (M8 × 25) × 4

4. Remove the 2 hose clamps to remove the 2 radiator hoses from the radiator and oil cooler.



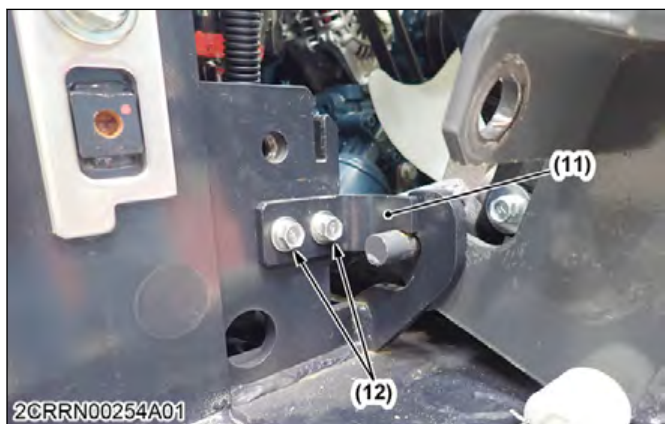
(6) Radiator hose × 2 (7) Hose clamp × 2

5. Remove the hose clamp and the 2 hoses to remove the reserve tank.



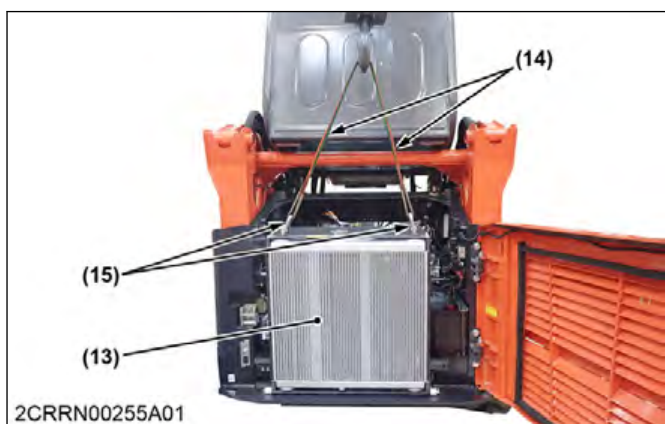
(8) Reserve tank (9) Hose × 2 (10) Hose clamp

6. Remove the 2 bolts to remove the radiator stopper.



(11) Radiator stopper (12) Bolt (M 8× 30) ×2

7. Attach 2 nylon slings with 2 shackles and hoist for support.



(13) Radiator and oil cooler (15) Shackle ×2
(14) Nylon sling ×2

8. Remove the radiator and oil cooler.

Mass

Radiator and oil cooler	Approximately 42 kg Approximately 93 lbs
-------------------------	---

Installing

Tightening torque

(7) Hose clamp	2.5 to 3.4 N·m 0.25 to 0.35 kgf·m 1.9 to 2.5 lbf·ft
----------------	---

■ IMPORTANT

- Before positioning the radiator and oil cooler back in place, secure the radiator hose to the stay so that the hose does not get caught between the fan shroud and the engine.

4.4 DPF muffler

4.4.1 Removing and installing the DPF muffler

⚠ CAUTION

- Do not work soon after the engine has stopped.
 - Engine, fuel, and oil are extremely hot.
 - Pressure in the fuel line is high.
- Keep fire and flammable items away from the working area.

■ IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

- Lower the front attachment to the ground, and stop the engine.
- Open the rear bonnet and insert the pin into the lock position.

⚠ CAUTION

- Check that the rear bonnet is securely locked.

- Disconnect the battery cable from negative (-) terminal.
- Tilt the radiator and oil cooler.
- Vacuum the refrigerant from the cooling circuit.
- Remove the upper bonnet.

Removing

- Remove the 3 bolts to remove the DPF exhaust pipe.



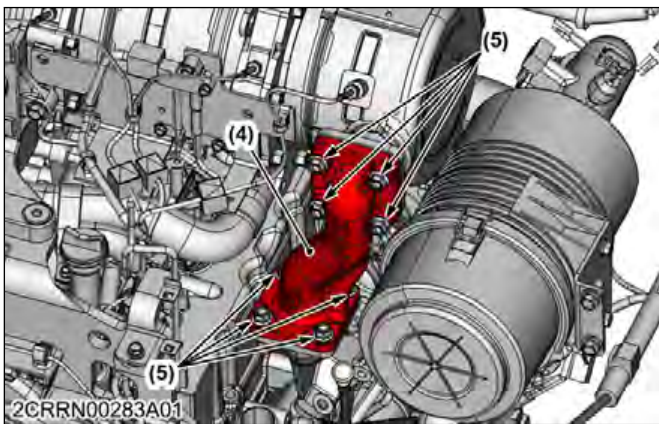
(1) DPF exhaust pipe (2) Bolt (M10 × 25) ×3

- Disconnect the 4 connectors.



(3) Connector ×4

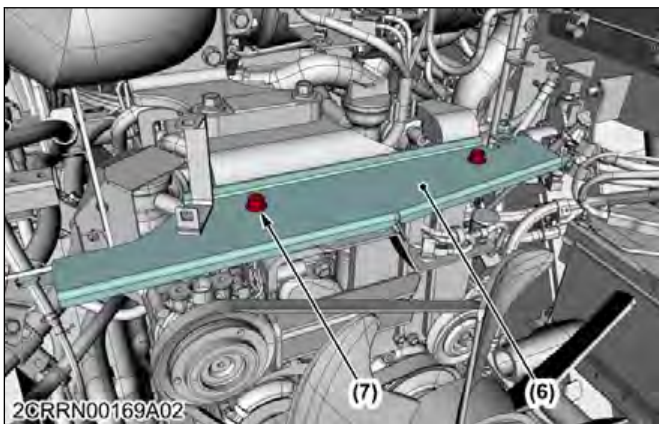
3. Remove the 8 nuts to remove the flange.



(4) Flange

(5) Nut ×8

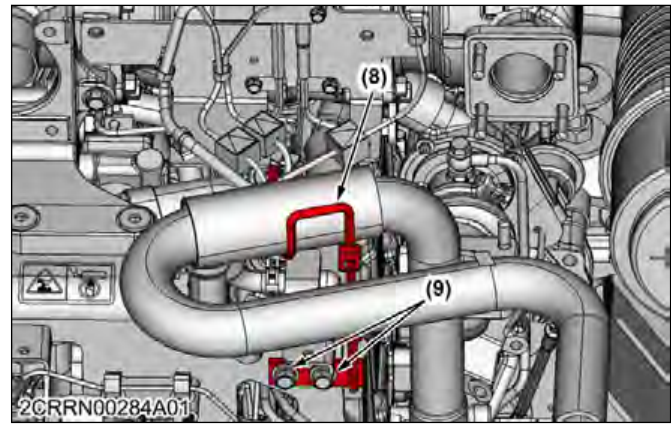
4. Remove the 2 bolts to remove the air conditioning belt cover.



(6) Air conditioning belt cover

(7) Bolt (M8 × 20) ×2

5. Remove the 2 bolts to remove the radiator hose stay.



(8) Radiator hose stay

(9) Bolt (M10 × 25) ×2

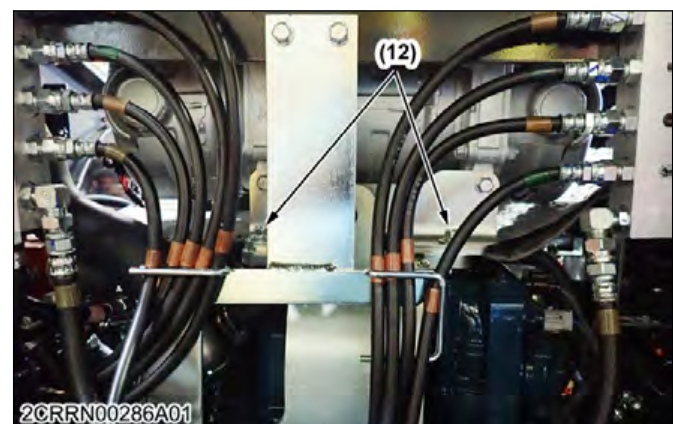
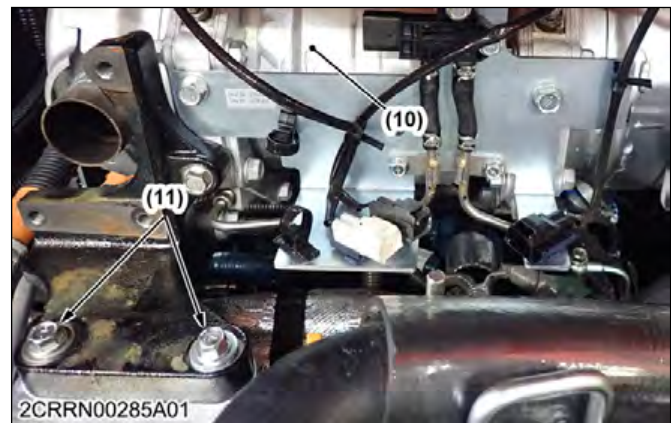
6. Remove the 4 bolts to remove the DPF muffler.

**CAUTION**

- The DPF muffler is extremely heavy. Handle it with at least 2 people when removing.

IMPORTANT

- To avoid breaking the temperature sensor, remove the DPF muffler carefully.



(10) DPF muffler

(11) Bolt (M10 × 40) ×2

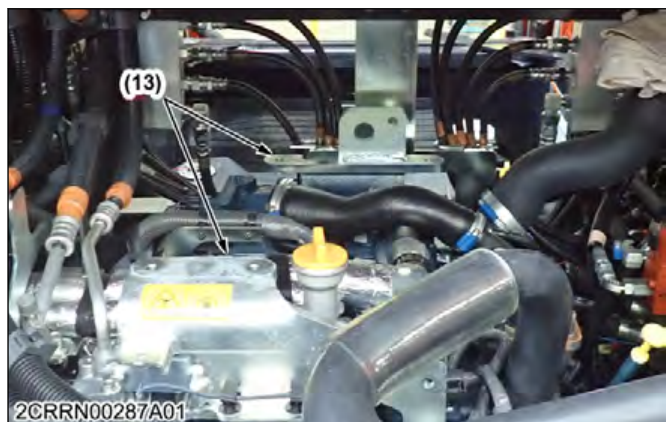
(12) Bolt (M10 × 25) ×2

Mass

(10) DPF muffler	Approximately 26 kg Approximately 57 lbs
------------------	---

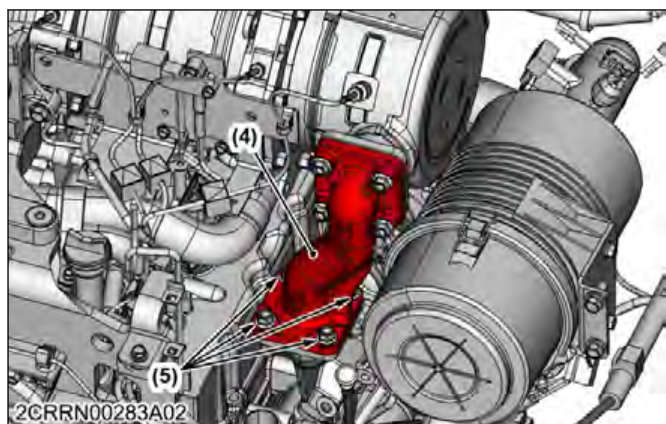
Installing

1. Place the DPF muffler on the engine stays.



(13) Engine stay ×2

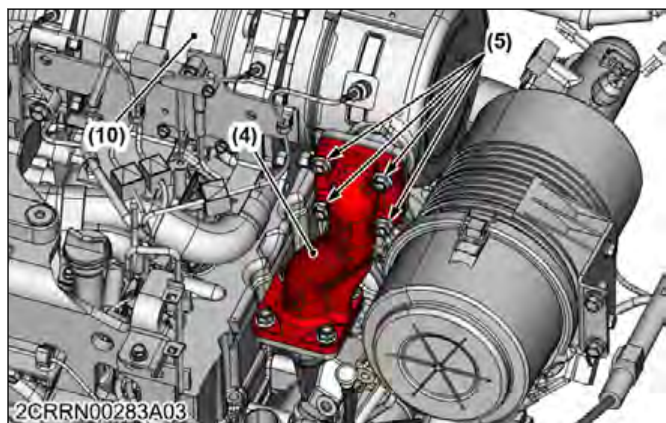
2. Tighten the 4 nuts to install the flange to the engine.



(4) Flange

(5) Nut ×4

3. Provisionally tighten the 4 nuts to install the flange to the DPF muffler.

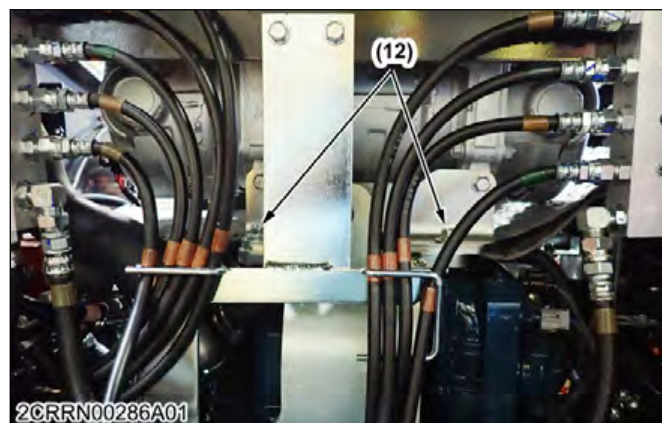
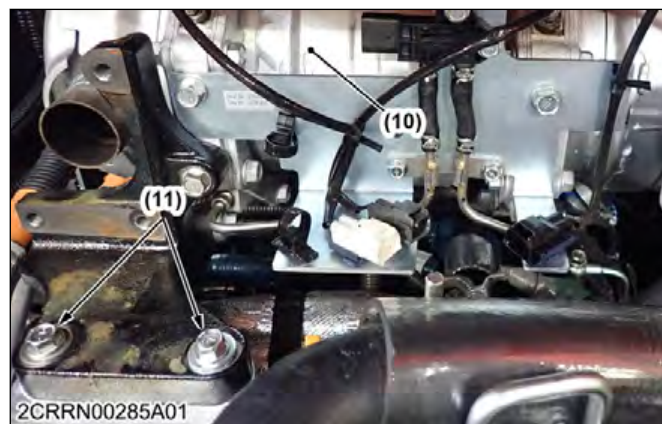


(4) Flange

(10) DPF muffler

(5) Nut ×4

4. Provisionally tighten the 4 bolts to install the DPF muffler.

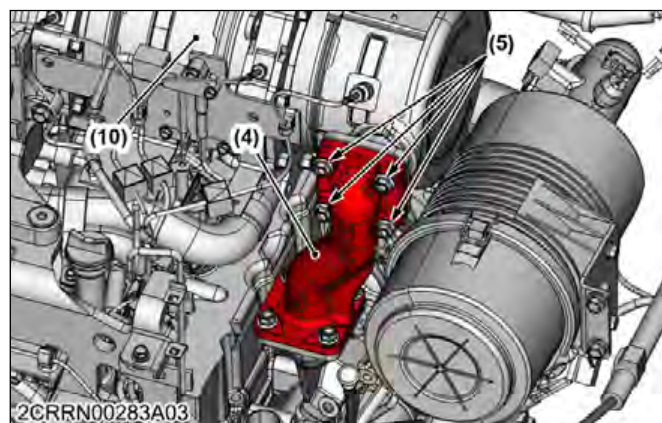


(10) DPF muffler

(12) Bolt (M10 × 25) ×2

(11) Bolt (M10 × 40) ×2

5. Tighten the 4 nuts to install the flange to the DPF muffler.

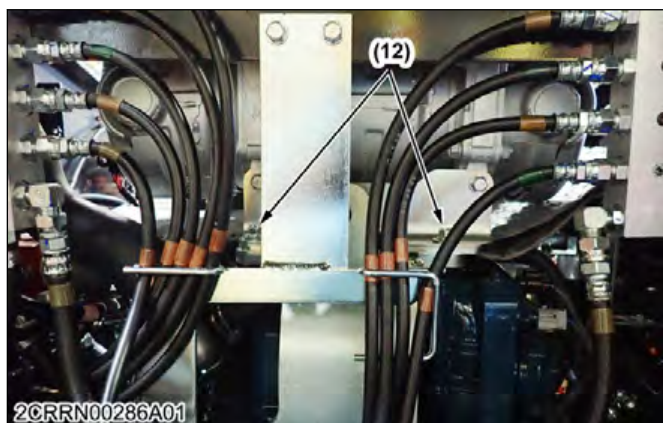
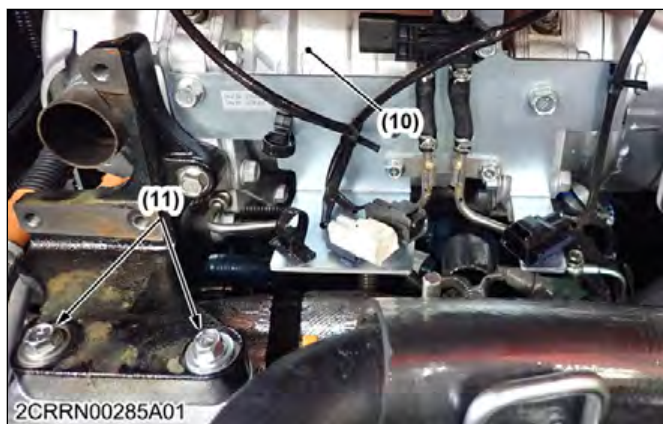


(4) Flange

(10) DPF muffler

(5) Nut ×4

6. Tighten the 4 bolts to install the DPF muffler.



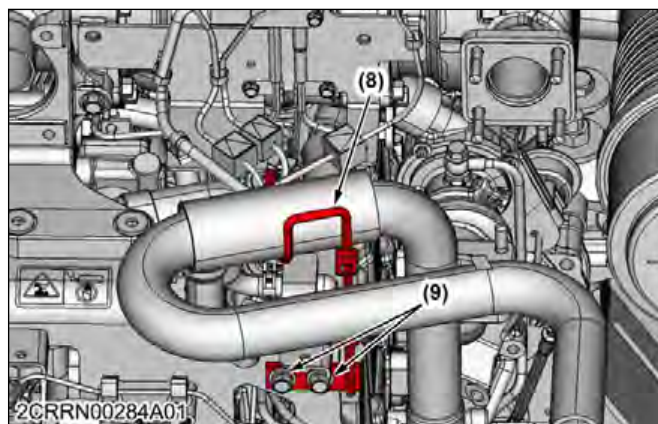
(10) DPF muffler
(11) Bolt (M10 × 40) × 2
(12) Bolt (M10 × 25) × 2

7. Tighten the 3 bolts to install the DPF exhaust pipe.



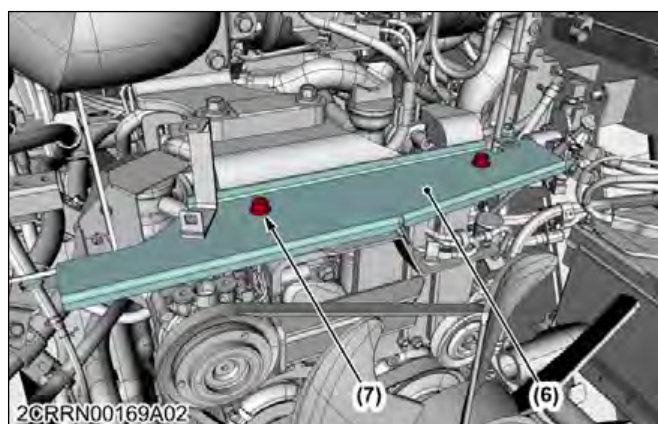
(1) DPF exhaust pipe
(2) Bolt (M10 × 25) × 3

8. Tighten the 2 bolts to install the radiator hose stay.



(8) Radiator hose stay
(9) Bolt (M10 × 25) × 2

9. Tighten the 2 bolts to install the air conditioning belt cover.



(6) Air conditioning belt cover
(7) Bolt (M8 × 20) × 2

■ IMPORTANT

- When replacing the DPF muffler with a new one, perform the following tasks on the Diagmaster and sign up the new code to the K-ISS.
 - “DPF Soot Load Reset”
 - “Auto Regeneration Inhibit Time Reset”
 - “DPF Regeneration Interval Time Reset”
 - “DPF Manual Regeneration Request Function”

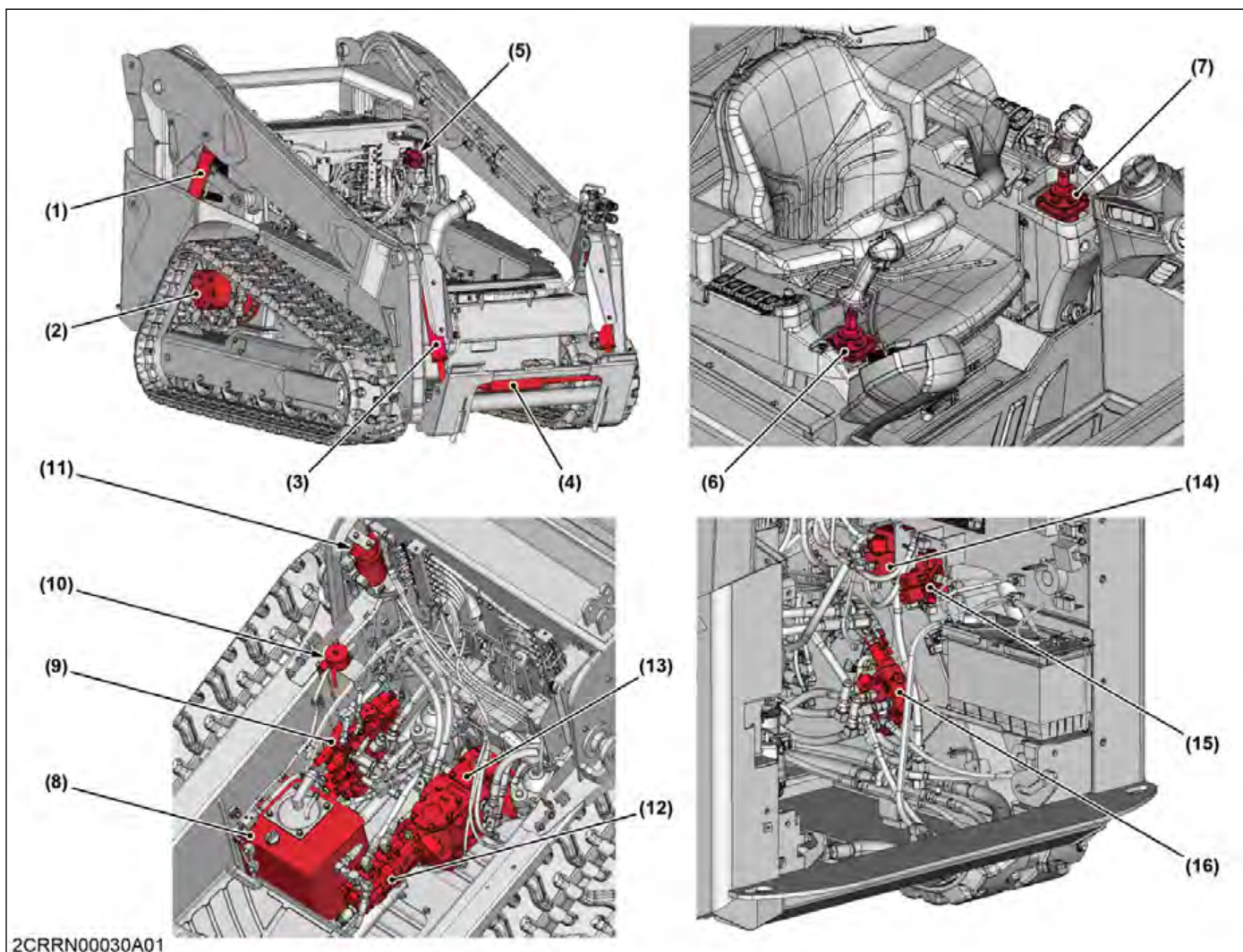
Tightening torque

(2) Bolt	48.1 to 55.9 N·m 4.90 to 5.70 kgf·m 35.5 to 41.2 lbf·ft
(5) Nut	48.1 to 55.9 N·m 4.90 to 5.70 kgf·m 35.5 to 41.2 lbf·ft
(11) Bolt	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft
(12) Bolt	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbf·ft

6. HYDRAULIC SYSTEM

MECHANISM

1. Hydraulic device layout

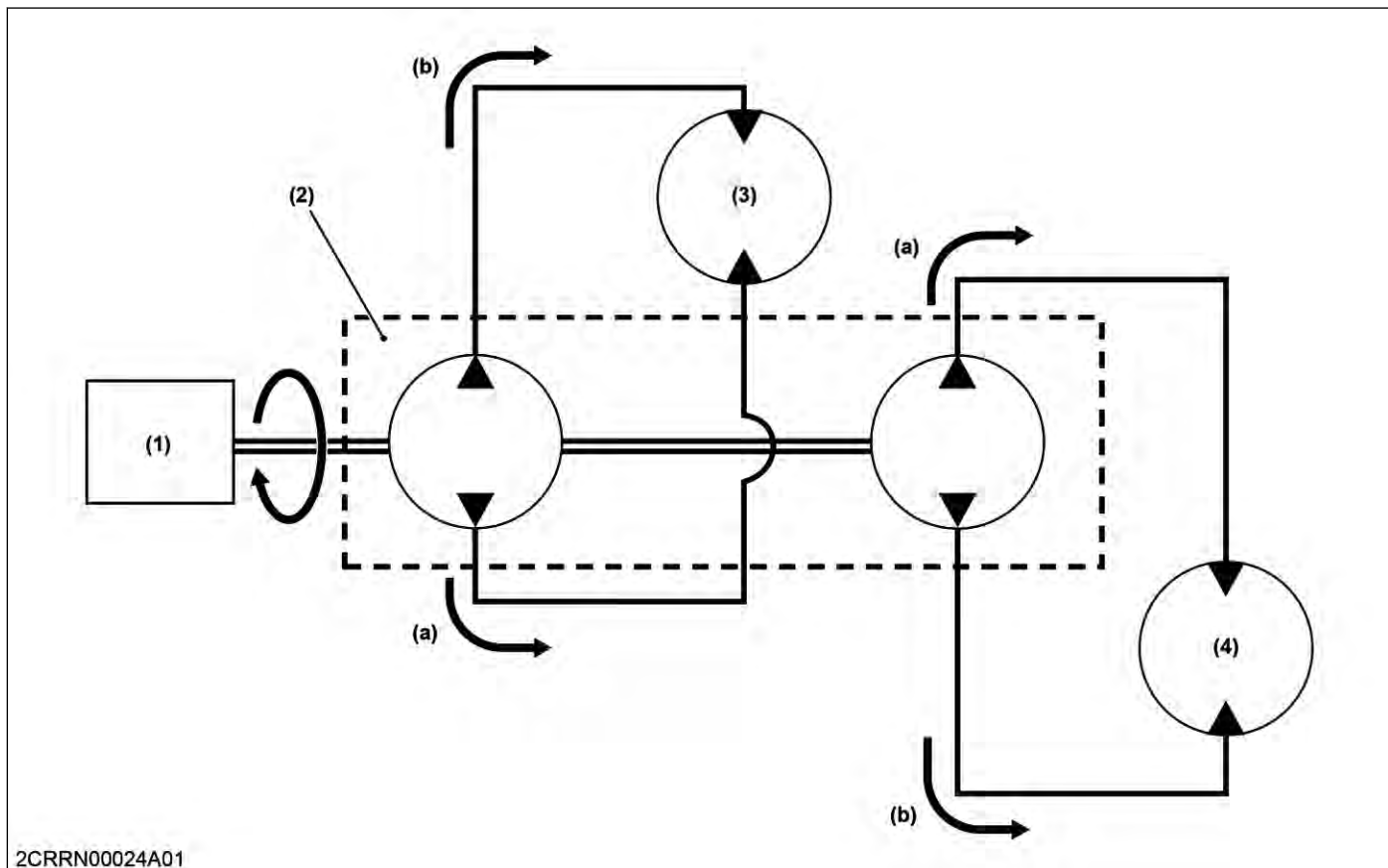


- | | | | |
|------------------------------------|------------------------------------|-------------------------------|---|
| (1) Lift arm cylinder | (6) Front attachment control valve | (11) HST filter | (15) Hydraulic quick hitch solenoid valve |
| (2) HST motor | (7) Travel control valve | (12) Gear pump | (16) Self-leveling solenoid valve |
| (3) Bucket cylinder | (8) Hydraulic oil tank | (13) HST pump | |
| (4) Hydraulic quick hitch cylinder | (9) Control valve | (14) High-flow solenoid valve | |
| (5) Unload valve | (10) Breather filter | | |

2. Hydraulic system general description

2.1 HST system general description

HST is a mechanism that the engine drives the HST pump to cause hydraulic pressure. The HST motors convert the hydraulic pressure to rotation.

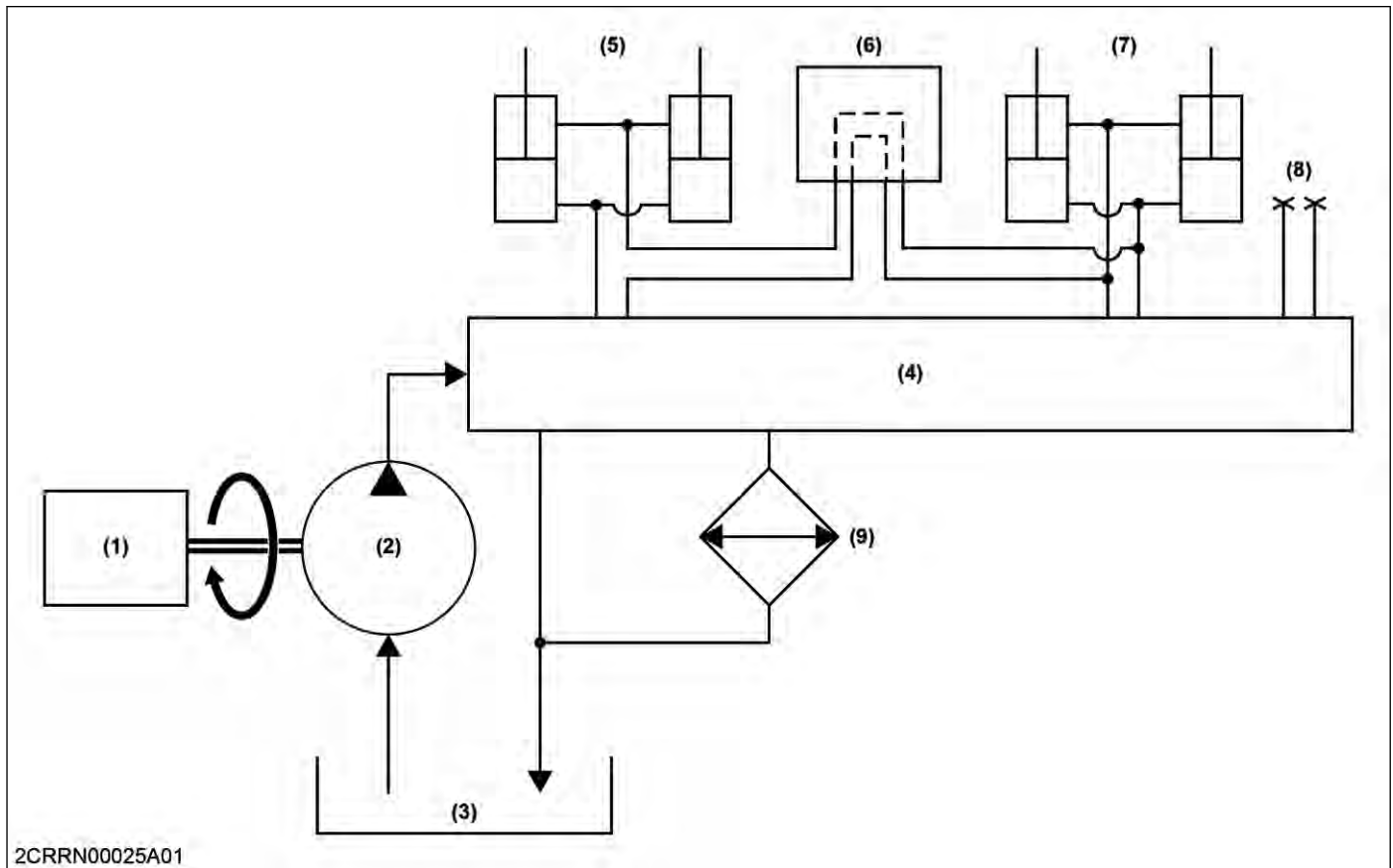


- | | | |
|--------------|------------------|---------------------------------|
| (1) Engine | (3) HST motor RH | (a) Oil flow to travel forward |
| (2) HST pump | (4) HST motor LH | (b) Oil flow to travel backward |

- By switching the discharging direction of the HST pump, the HST motor rotates forward or backward.
- Flow rate increases as revving up the engine, allowing to change the HST motor rotation speed easily.

2.2 Front attachment system general description

The front attachment is powered by the pressurized oil from the main pump, and operated by switching oil passages inside the control valve.



- | | | |
|------------------------|----------------------------------|---------------------|
| (1) Engine | (4) Control valve | (7) Bucket cylinder |
| (2) Main pump | (5) Lift arm cylinder | (8) AUX port |
| (3) Hydraulic oil tank | (6) Self-leveling solenoid valve | (9) Oil cooler |

When not operating

- The main pump supplies the hydraulic oil to the control valve.
- After entering the control valve, the hydraulic oil returns to the hydraulic oil tank.

When operating the lift arm

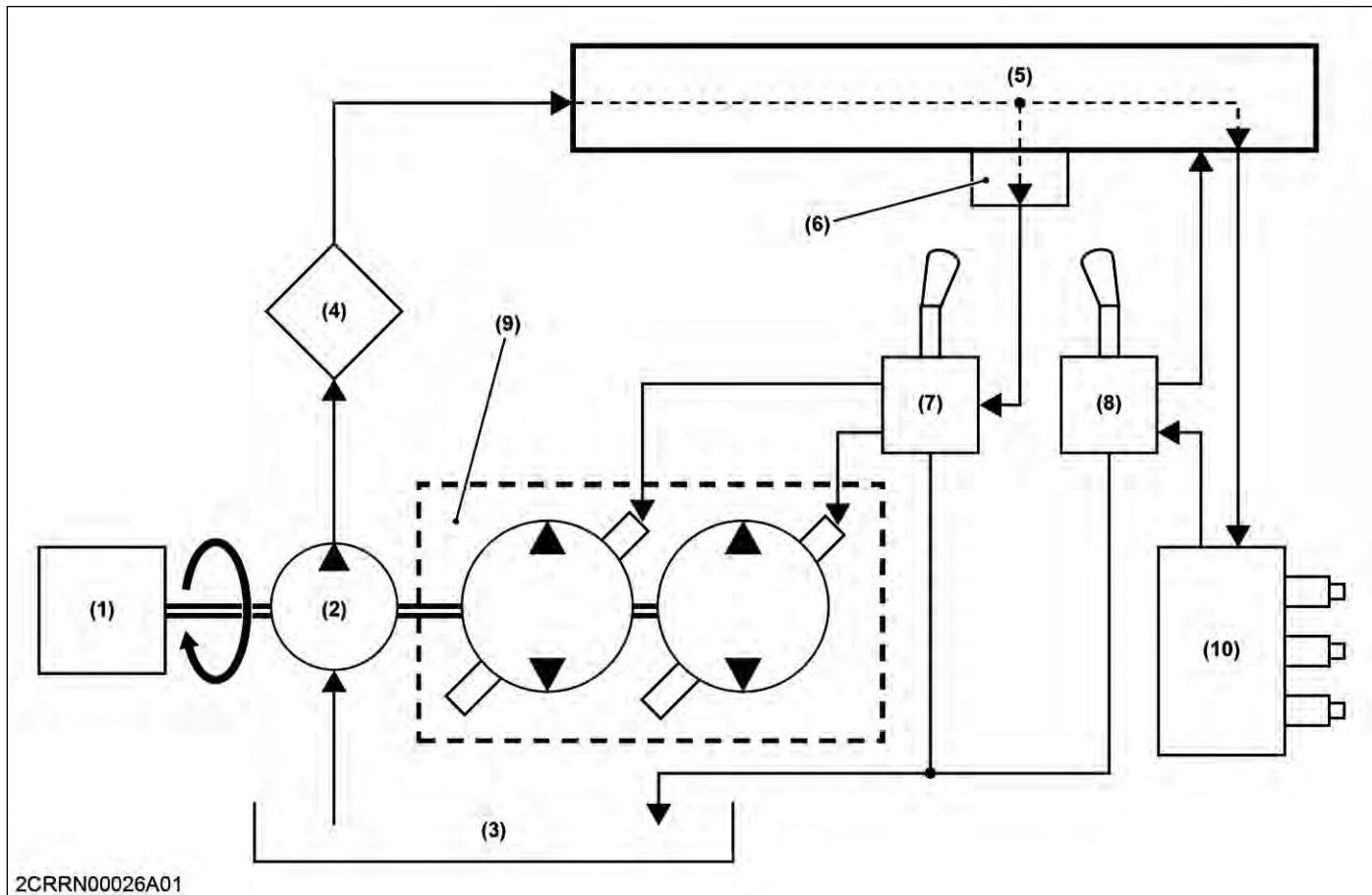
- When the front attachment control lever is operated forward or backward, oil passages inside of the control valve are switched.
- When raising the lift arm with the self-leveling switch ON
 - The hydraulic oil from the rod side of the lift arm cylinder flows into the bottom side of the bucket cylinder via the self-leveling solenoid valve, and make the bucket crowd.
 - The hydraulic oil from the rod side of the bucket cylinder returns to the control valve via the self-leveling solenoid valve.
- When raising the lift arm with the self-leveling switch OFF, or when lowering the lift arm
 - The hydraulic oil from the lift arm cylinder returns to the control valve without entering the bucket cylinder.
- The hydraulic oil reached to the control valve returns to the hydraulic oil tank.

When operating the bucket

- When the front attachment control lever is operated right or left, oil passages inside of the control valve are switched.
- The pressurized oil from the main pump flows into the bucket cylinder, and the bucket performs crowding or dumping operation.
- The hydraulic oil from the bucket cylinder returns to the control valve without entering the self-leveling solenoid valve.
- The hydraulic oil reached to the control valve returns to the hydraulic oil tank.

2.3 Pilot system general description

Operation of the front attachment and traveling is powered by the pressurized oil from the charge pump. The operation can be switched by operating the control lever.



- | | | | |
|------------------------|------------------------|------------------------------------|-------------------|
| (1) Engine | (4) HST filter | (7) Travel control valve | (10) Unload valve |
| (2) Charge pump | (5) Control valve | (8) Front attachment control valve | |
| (3) Hydraulic oil tank | (6) Proportional valve | (9) HST pump | |

When not operating

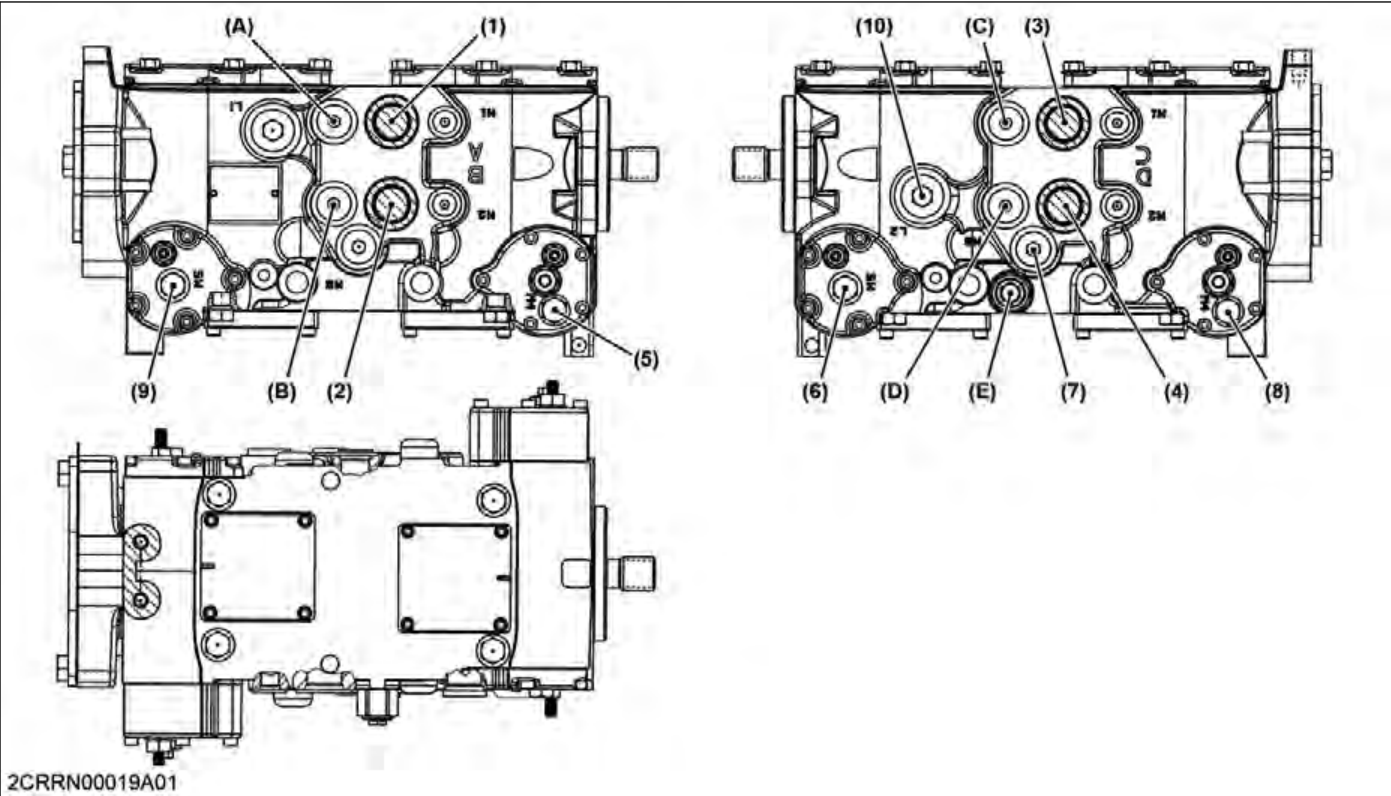
- The charge pump supplies the hydraulic oil to the control valve.
- After entering the control valve, the hydraulic oil flows into each pilot control valve and stops there.

When operating the travel control valve or the front attachment control valve

- When the travel control lever is operated, oil passages inside of the travel control valve are switched.
 - The hydraulic oil from the charge pump flows toward the HST pump and changes the angle of the swash plate. The direction of the oil flow toward the HST motor is determined forward or backward.
- When the front attachment control lever is operated, oil passages inside of the front attachment control valve are switched.
 - The hydraulic oil from the charge pump flows into the control valve and changes the oil passages inside of the control valve. The front attachment starts its operation.
- The oil used for operation returns to the hydraulic oil tank.

3. HST pump

3.1 HST pump specifications



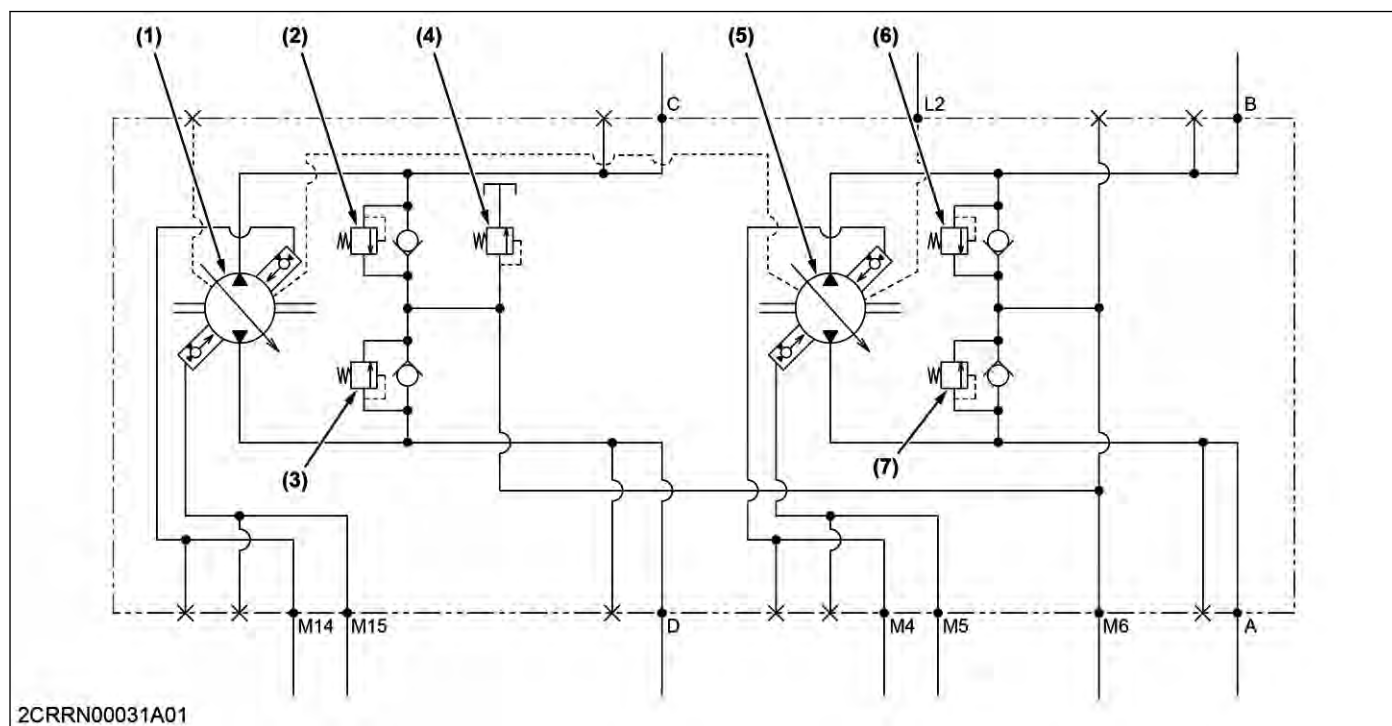
- (A) High pressure relief valve (aLB)
- (B) High pressure relief valve (aLF)
- (C) High pressure relief valve (aRB)
- (D) High pressure relief valve (aRF)
- (E) Charge relief valve (pCR)

	Specifications	Remarks
Manufacturer	Daikin-Sauer-Danfoss	—
Model	11188587	—
Direction of rotation	Rotates right viewed from the engine	—
Displacement	2 × 28.0 cm ³ /rev 2 × 1.71 in. ³ /rev	—
High pressure relief valve setting pressure	35.0 MPa 357 kgf/cm ² 5080 psi	At 3.8 to 5.6 L/min At 1.0 to 1.5 U.S.gals/min
Charge relief valve setting pressure	3.0 MPa 31 kgf/cm ² 440 psi	At 37.9 L/min At 10.0 U.S.gals/min

Port location table

No.	Port	Location	No.	Port	Location
(1)	Port A	HST motor LH (port B) HST motor LH backward movement	(6)	Port M5	Travel control valve (port 2) HST motor LH forward movement
(2)	Port B	HST motor LH (port A) HST motor LH forward movement	(7)	Port M6	HST filter
(3)	Port C	HST motor RH (port A) HST motor RH backward movement	(8)	Port M14	Travel control valve (port 1) HST motor RH forward movement
(4)	Port D	HST motor RH (port B) HST motor RH forward movement	(9)	Port M15	Travel control valve (port 3) HST motor RH backward movement
(5)	Port M4	Travel control valve (port 4) HST motor LH backward movement	(10)	Port L2	Hydraulic oil tank

3.2 HST pump hydraulic circuit

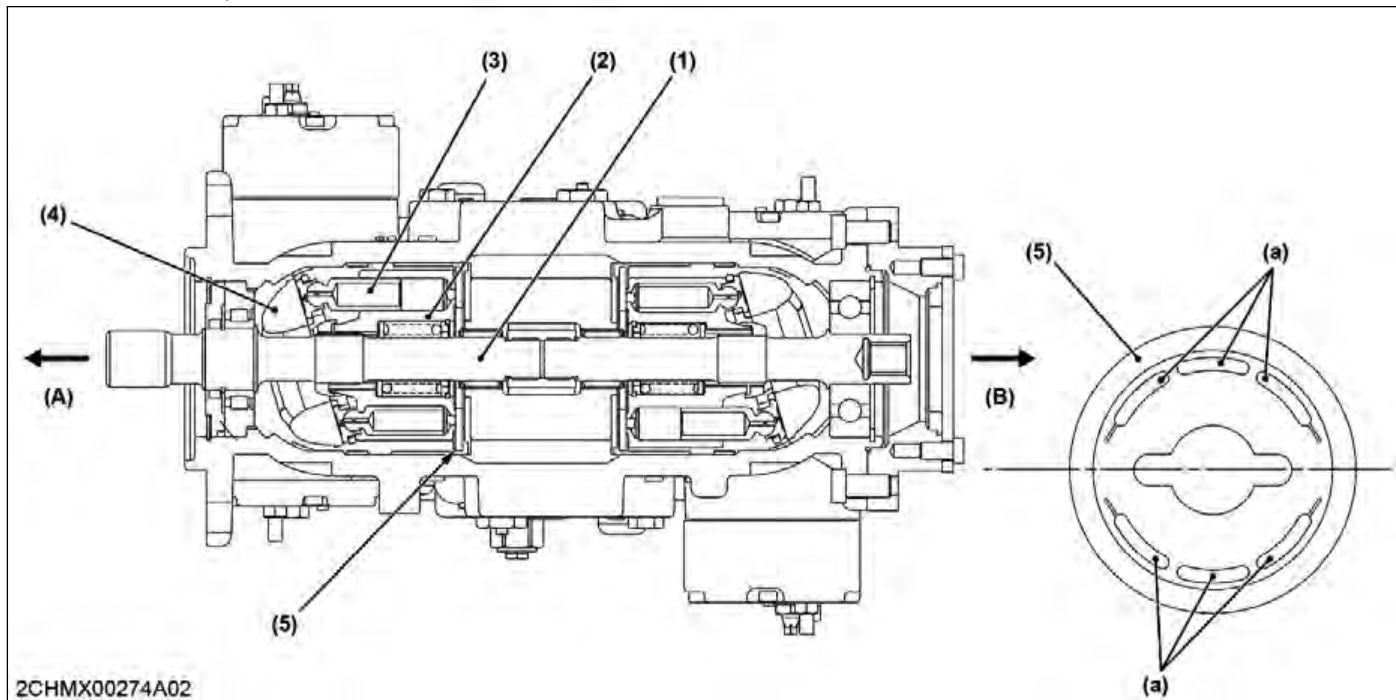


- | | | | |
|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|
| (1) HST pump RH | (3) High pressure relief valve (aRF) | (5) HST pump LH | (7) High pressure relief valve (aLB) |
| (2) High pressure relief valve (aRB) | (4) Charge relief valve (pCR) | (6) High pressure relief valve (aLF) | |

3.3 HST pump function and structure

3.3.1 HST pump working principles

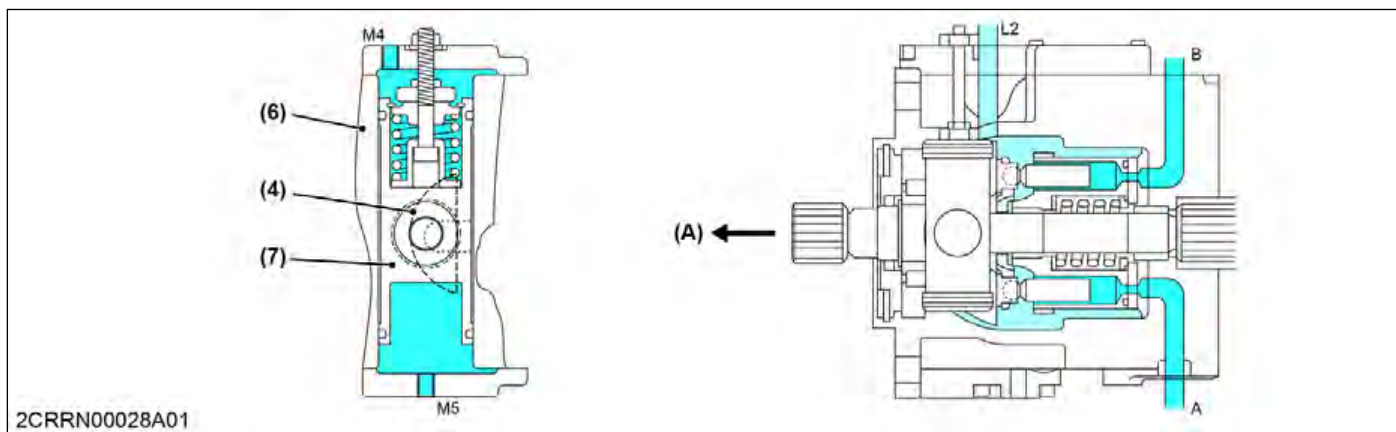
The HST pump is connected to the HST motor in the closed circuit, and switches the travel operations (neutral, forward, backward).



- | | | | |
|--------------------|-----------------|-------------------------------|--------------------|
| (1) Shaft | (3) Piston | (5) Valve plate | (A) Engine side |
| (2) Cylinder block | (4) Swash plate | (a) Suction or discharge port | (B) Gear pump side |

- When rotating the engine, the cylinder block, which is connected by the drive shaft, rotates simultaneously.
- There are 9 pistons integrated into the cylinder block.
- Pistons reciprocate in the cylinder block according to the rotation of the cylinder block and the angle of the swash plate.
- The hydraulic oil is suctioned and discharged continuously by reciprocation of the pistons.
 - Suction: The hydraulic oil is suctioned through the valve plate into the cylinder block. The pistons move toward the direction which the pistons go out.
 - Discharge: The hydraulic oil is discharged from the cylinder block through the valve plate. The pistons move toward the direction which the pistons go into.
- When the swash plate angle changes, the reciprocation stroke of the pistons changes, and the amount of suction or discharge is also changed.

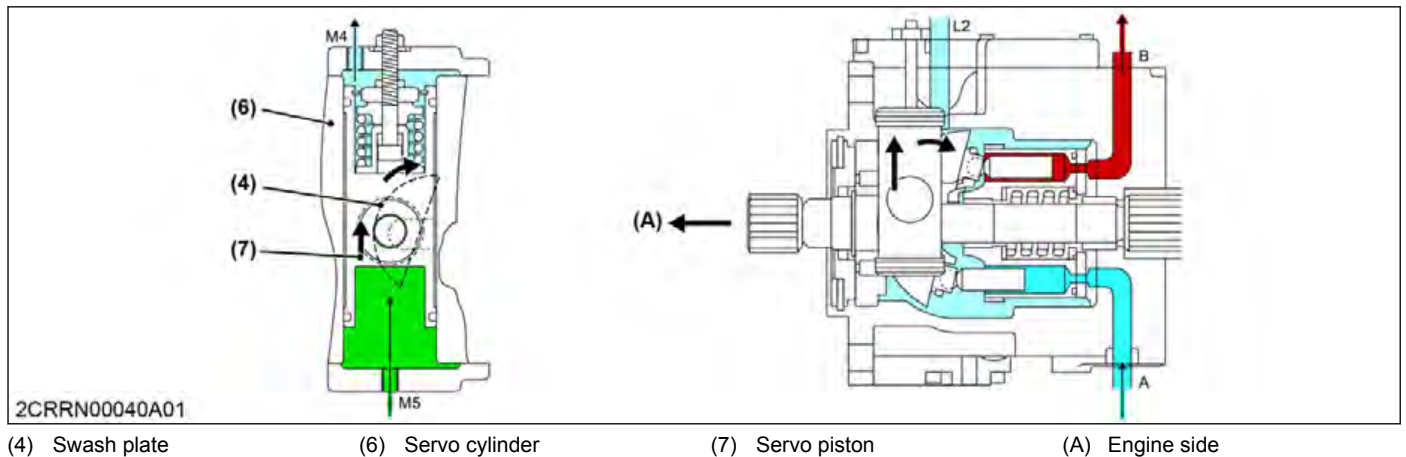
When the swash plate is in neutral position



- | | | | |
|-----------------|--------------------|------------------|-----------------|
| (4) Swash plate | (6) Servo cylinder | (7) Servo piston | (A) Engine side |
|-----------------|--------------------|------------------|-----------------|

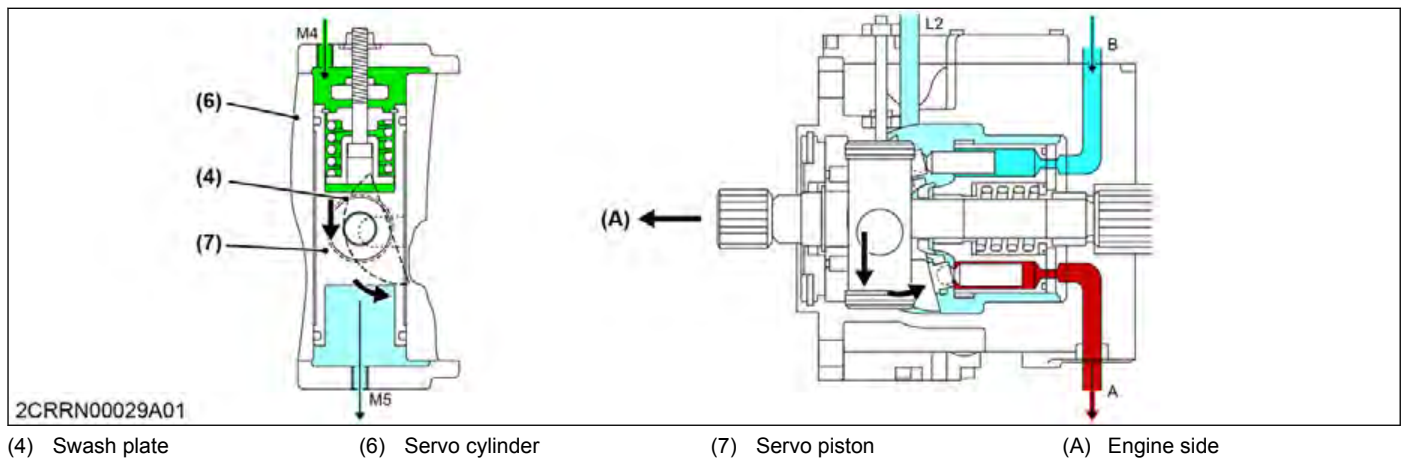
- The HST pump does not discharge the hydraulic oil, as the swash plate angle is in the neutral position.

When traveling forward



- The hydraulic oil from the travel control valve flows into port M5.
- The servo piston is pressed by the hydraulic oil from port M5.
- The swash plate angle is changed to discharge high pressure oil from port B, as the swash plate is connected to the servo piston.
- The hydraulic oil from the HST motor enters port A.

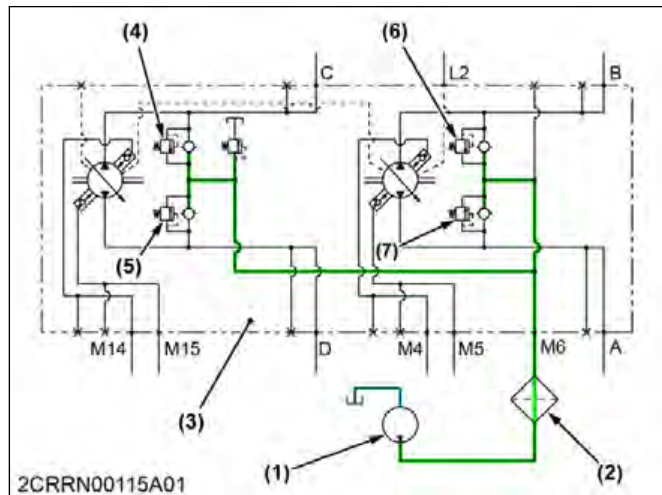
When traveling backward



- The hydraulic oil from the travel control valve flows into port M4.
- The servo piston is pressed by the hydraulic oil from port M4.
- The swash plate angle is changed to discharge high pressure oil from port A, as the swash plate is connected to the servo piston.
- The hydraulic oil from the HST motor enters port B.

3.3.2 Charging

Replenishes the hydraulic oil to the closed circuit as the hydraulic oil decreases by the flushing function of the HST motor.

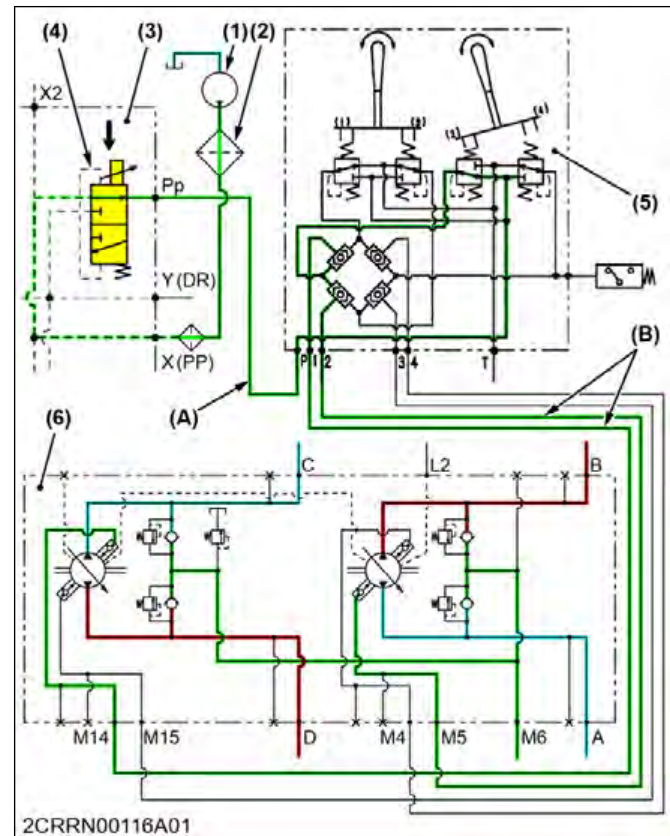


- | | |
|--------------------------------------|--------------------------------------|
| (1) Charge pump | (6) High pressure relief valve (aLF) |
| (2) HST filter | (7) High pressure relief valve (aLB) |
| (3) HST pump | |
| (4) High pressure relief valve (aRB) | |
| (5) High pressure relief valve (aRF) | |

- The pressurized oil from the charge pump flows into port M6 of the HST pump.
- The hydraulic oil is supplied to the closed circuit via each high pressure relief valve.

3.3.3 Anti-stall

Prevents the engine from stalling when a high load is applied to the engine.



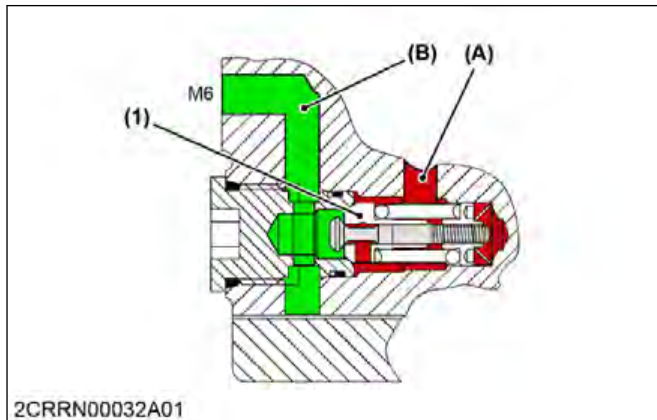
- | | |
|--------------------------|--|
| (1) Charge pump | (6) HST pump |
| (2) HST filter | (A) Pilot primary pressure of the travel control valve |
| (3) Control valve | (B) Pilot secondary pressure of the travel control valve |
| (4) Proportional valve | |
| (5) Travel control valve | |

- When a high load is applied to the engine, the engine speed decreases.
- The main ECU compares the target engine speed and the actual engine speed.
- The main ECU applies the voltage to the proportional valve according to the difference of the engine speed.
- The proportional valve controls the pilot primary pressure of the travel control valve.
- The pilot secondary pressure of the travel control valve is lowered, and the swash plate angle of the HST pump decreases.
- The flow rate from the HST pump to the HST motor decreases.
- The horse power consumption by the HST pump is reduced.
- The engine load is reduced, and it prevents the engine from stalling.

3.3.4 High pressure relief valve

Prevents surge pressure in the HST closed circuit. Also has the function as the check valve for the charge pressure.

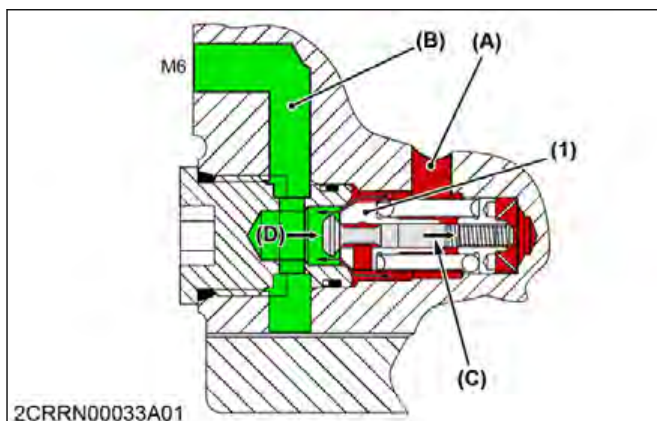
When not relieving



- (1) High pressure relief valve (B) Charge pump circuit
(A) HST closed circuit

- The pressurized oil from the charge pump flows into port M6, and reaches the high pressure relief valve.
- The high pressure relief valve is caught between HST closed circuit and charge circuit.
- The hydraulic oil in the charge circuit presses the high pressure relief valve right, and is supplied to the HST closed circuit.

When relieving



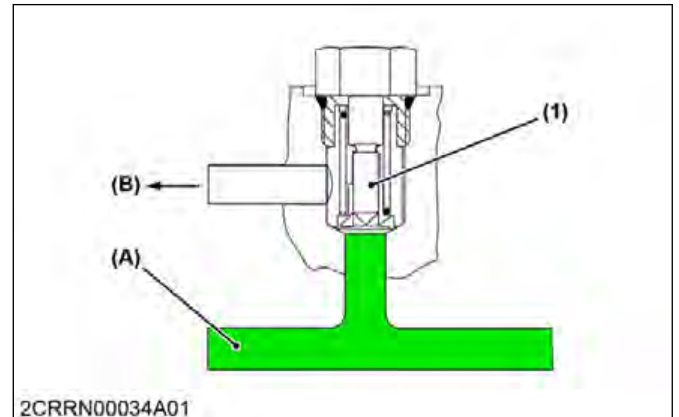
- (1) High pressure relief valve (C) Force of HST pump pressure
(A) HST closed circuit (D) Force of charge pump pressure
(B) Charge pump circuit

- When the HST pump pressure gets higher than the set pressure, the HST pump pressure presses the high pressure relief valve.
 - The pressurized oil from the HST pump flows to the charge circuit, and returns to the hydraulic oil tank via the charge relief valve.

3.3.5 Charge relief valve

Prevents surge pressure in the charge circuit.

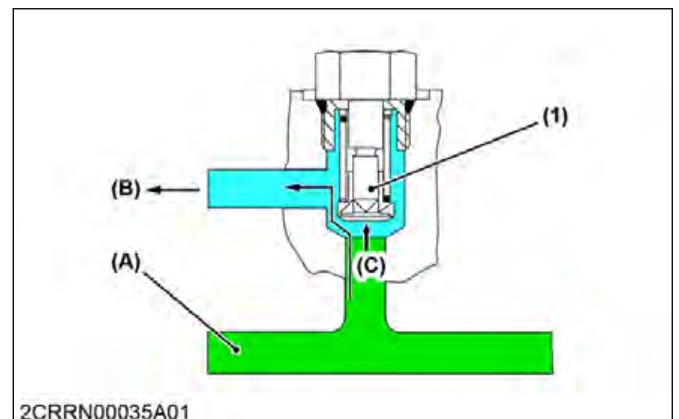
When not relieving



- (1) Charge relief valve (B) To port L2
(A) Charge circuit

- The pressurized oil from the charge pump flows into the port M6, and reaches the charge relief valve.
- Since the charge pressure is lower than the setting pressure of the charge relief valve, the relief valve does not move.

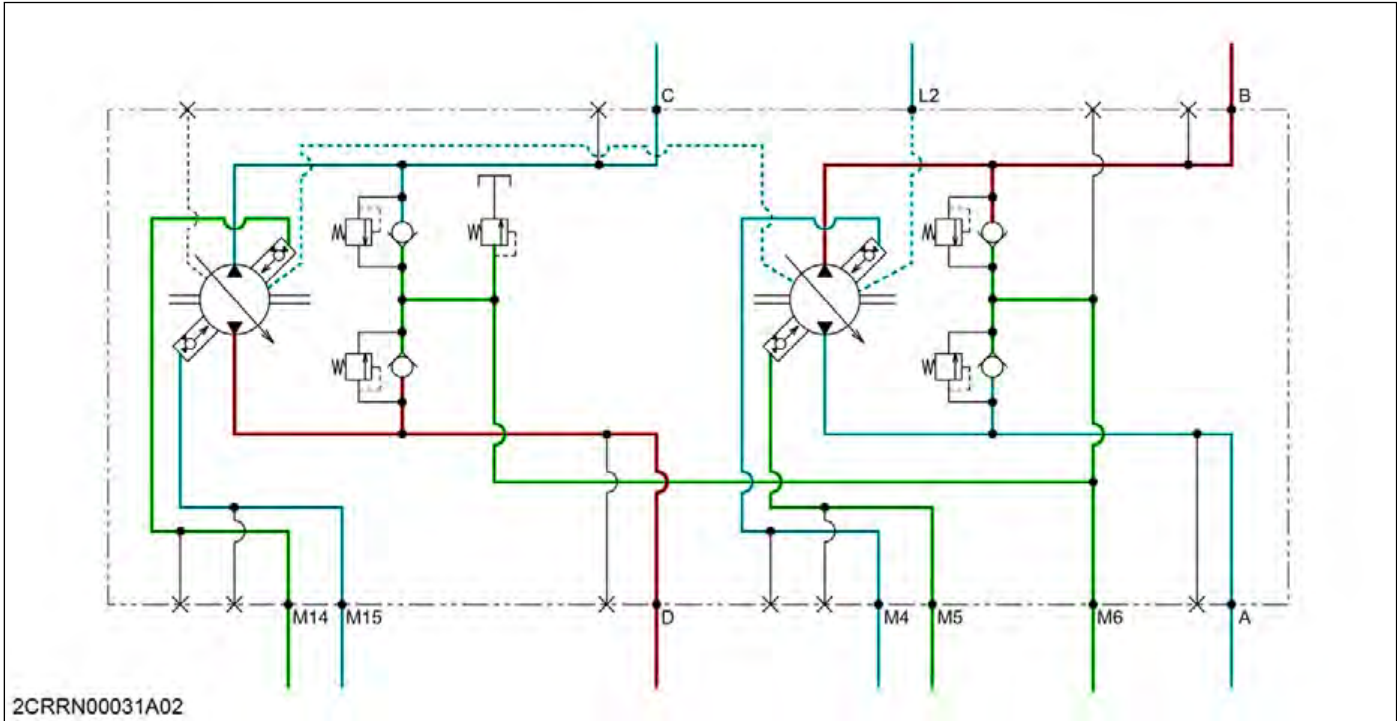
When relieving



- (1) Charge relief valve (B) To port L2
(A) Charge circuit (C) Charge pressure

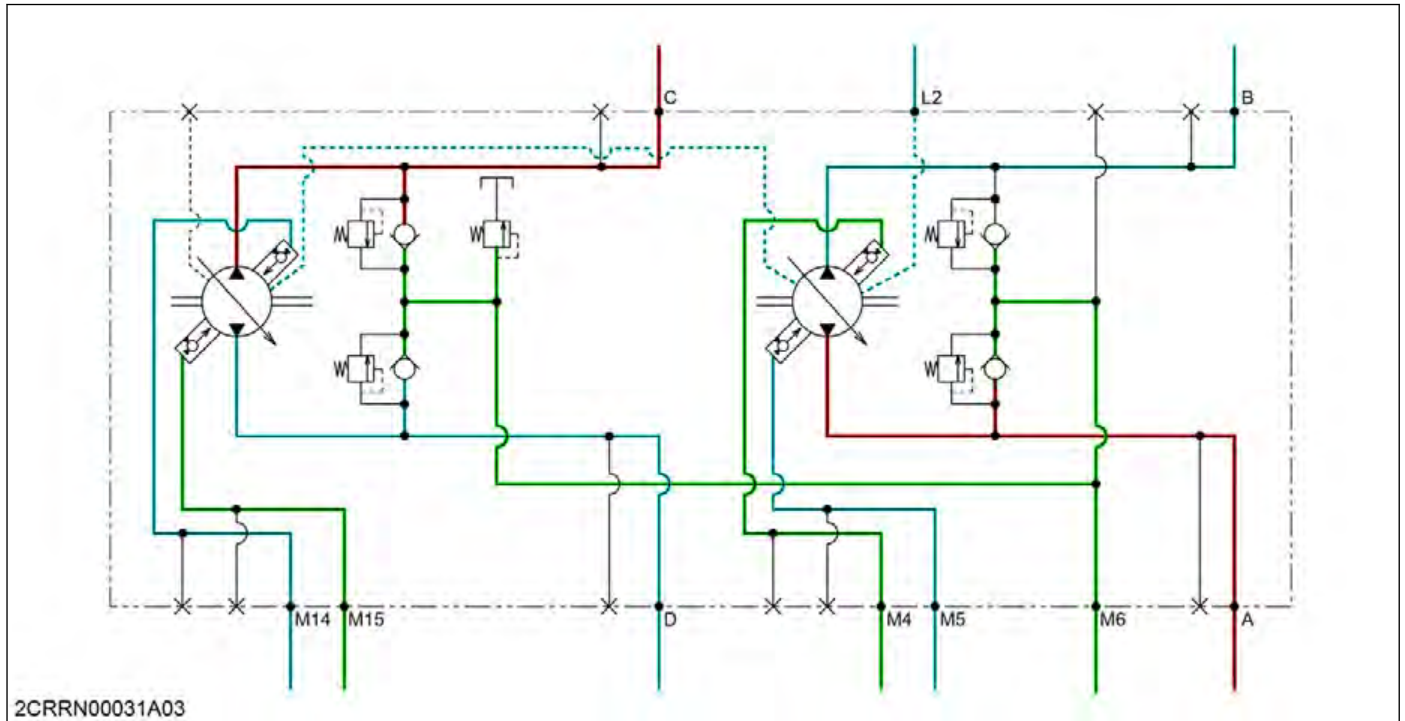
- When the charge pressure gets higher than the set pressure, the charge pressure presses the charge relief valve.
- The pressurized oil from the charge pump returns to the hydraulic oil tank through the port L2.

3.3.6 Forward traveling circuit



- When the travel control lever is in forward traveling position, the pressurized oil from the charge pump flows into port M14 and port M5.
- The pressurized oil from the charge pump flows into the one side of the servo cylinder, and changes the swash plate angle to forward traveling position.
- The hydraulic oil in the closed circuit starts flowing to the HST motor.

3.3.7 Backward traveling circuit

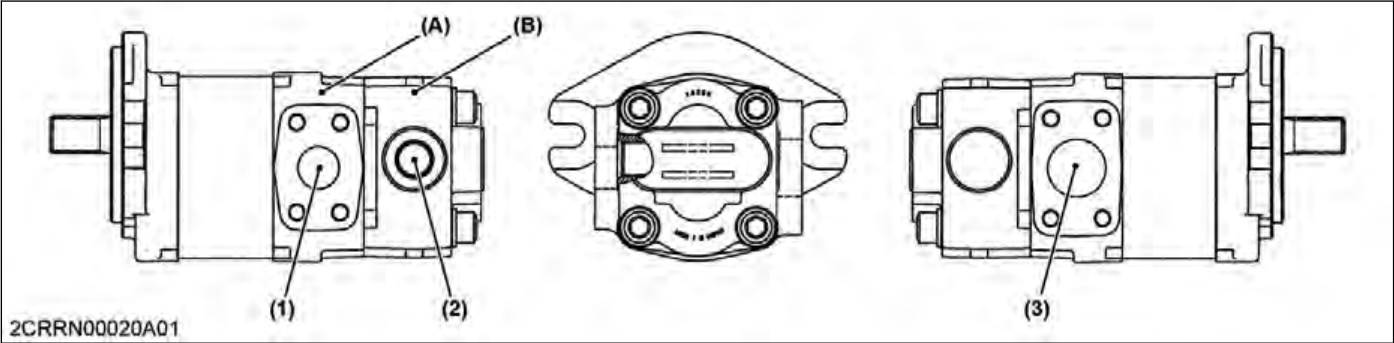


- When the travel control lever is in backward traveling position, the pressurized oil from the charge pump flows into port M15 and port M4.
- The pressurized oil from the charge pump flows into the one side of the servo cylinder, and changes the swash plate angle to backward traveling position.
- The hydraulic oil in the closed circuit starts flowing to the HST motor.

4. Gear pump

4.1 Gear pump specifications

Normal flow specification



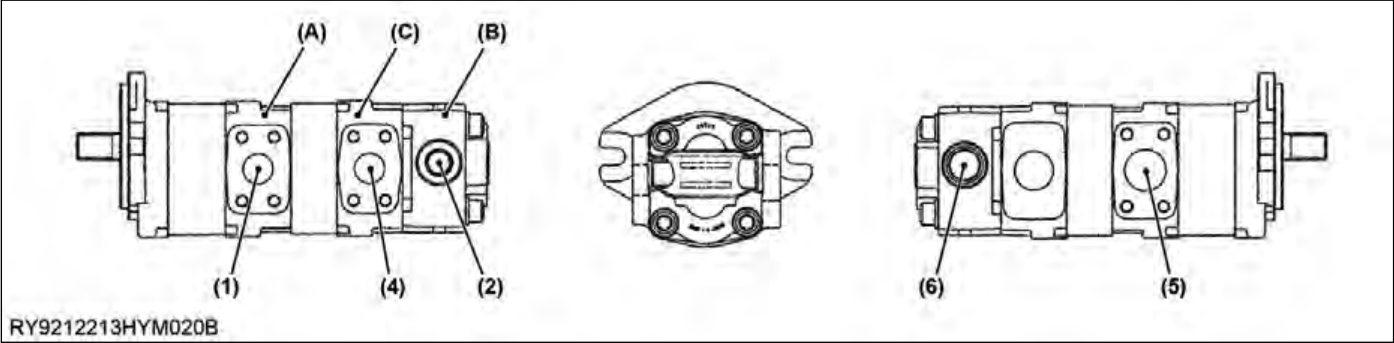
(A) Main pump (B) Charge pump

		Specifications
Manufacturer		Shimadzu Corporation
Model		EDK2B2517F1H1-R248
Direction of rotation		Rotates right viewed from the engine
Displacement	Main pump	25.3 cm ³ /rev 1.54 in. ³ /rev
	Charge pump	17.1 cm ³ /rev 1.04 in. ³ /rev

Port location table

No.	Port	Location
(1)	Main pump discharge port	Control valve (port P)
(2)	Charge pump discharge port	HST filter Hydraulic quick hitch solenoid valve (port P)
(3)	Suction port	Hydraulic oil tank

High-flow specification



(A) Main pump (B) Charge pump (C) High-flow pump

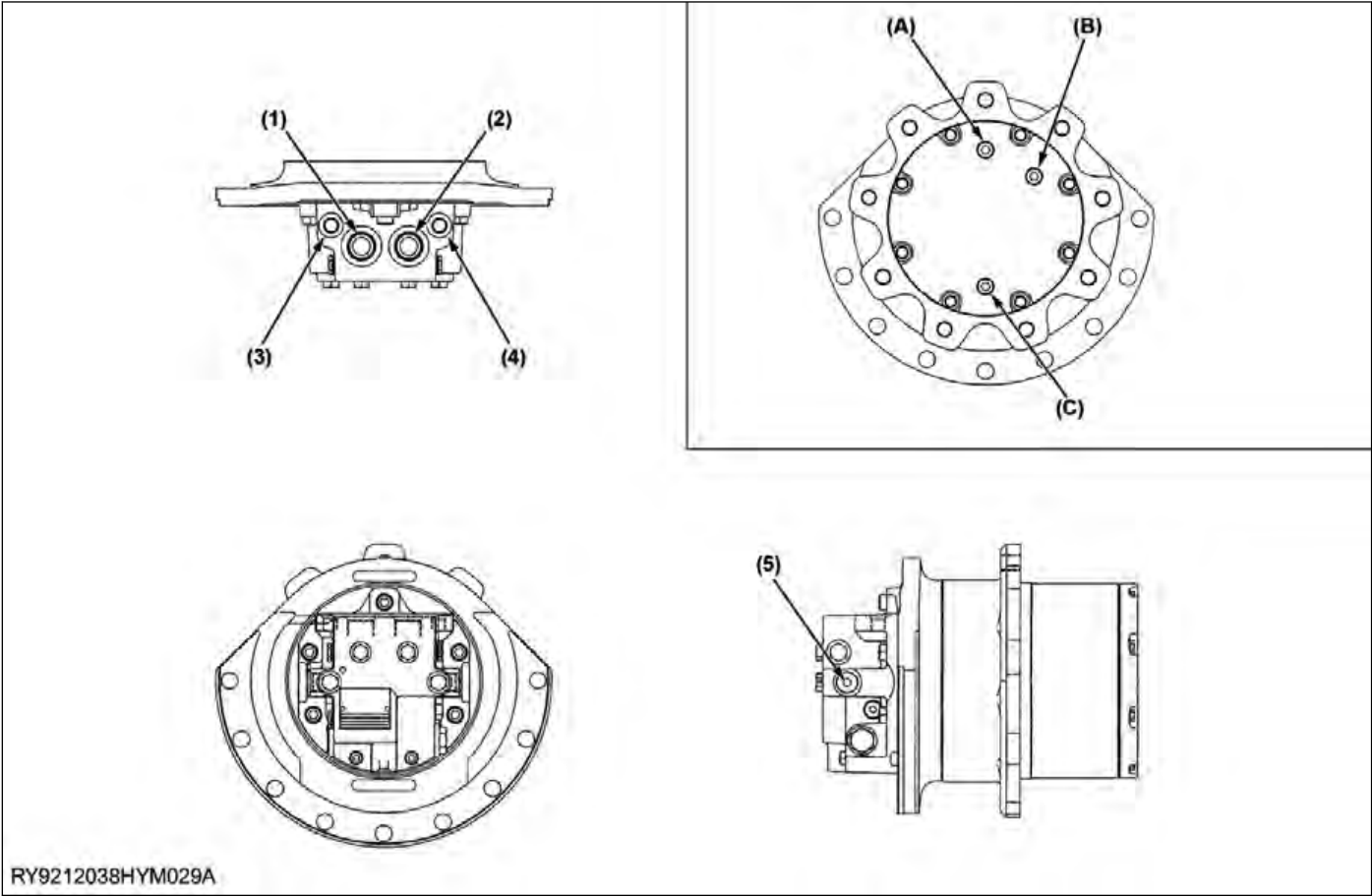
		Specifications
Manufacturer		Shimadzu Corporation
Model		ETK2B251417G9H1-R249
Direction of rotation		Rotates right viewed from the engine
Displacement	Main pump	25.3 cm ³ /rev 1.54 in. ³ /rev
	High-flow pump	14.0 cm ³ /rev 0.85 in. ³ /rev
	Charge pump	17.1 cm ³ /rev 1.04 in. ³ /rev

Port location table

No.	Port	Location
(1)	Main pump discharge port	Control valve (port P)
(2)	Charge pump discharge port	HST filter Hydraulic quick hitch solenoid valve (port P)
(4)	High-flow pump discharge port	High-flow solenoid valve (port P)
(5)	First suction port	Hydraulic oil tank
(6)	Second suction port	Hydraulic oil tank

5. HST motor

5.1 HST motor specifications



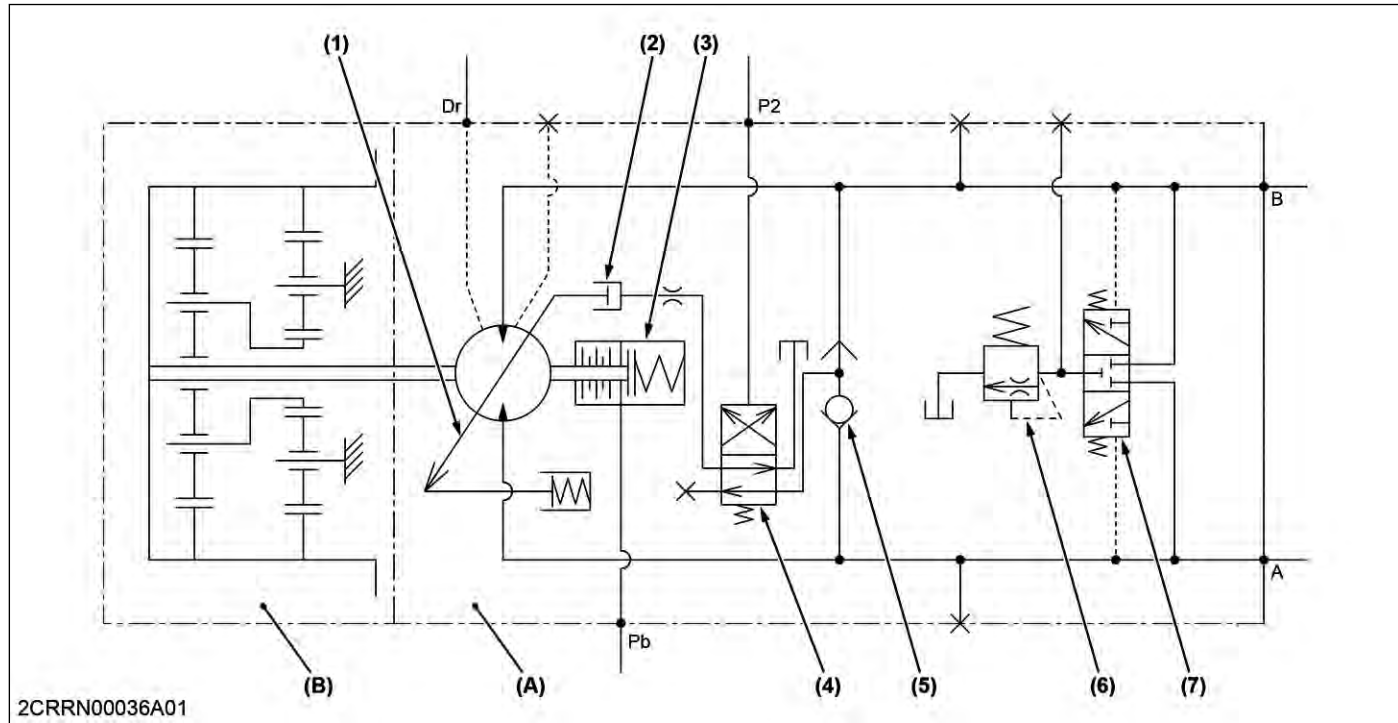
(A) Oil supply port (B) Oil inspection port (C) Oil drain port

		Specifications
Manufacturer		Daikin-Sauer-Danfoss
Model		11196590
Direction of rotation (viewed from the reduction gear side)	Right rotation	Port A: discharge, port B: suction
	Left rotation	Port A: suction, port B: discharge
Displacement	Low speed	28.0 cm ³ /rev 1.71 in. ³ /rev
	High speed	19.1 cm ³ /rev 1.17 in. ³ /rev
Reduction ratio		25.68
Parking brake release pressure		1.5 MPa 15.3 kgf/cm ² 218 psi
Flushing relief valve setting pressure		1.0 MPa 10.2 kgf/cm ² 145 psi

Port location table

No.	Port	Location	
		HST motor LH	HST motor RH
(1)	Port A	HST pump (port B) Travel forward	HST pump (port C) Travel backward
(2)	Port B	HST pump (port A) Travel backward	HST pump (port D) Travel forward
(3)	Port P2	Unload valve (port A2) Travel speed shift	
(4)	Port Pb	Unload valve (port A1) Parking brake	
(5)	Port Dr	Hydraulic oil tank	

5.2 HST motor hydraulic circuit



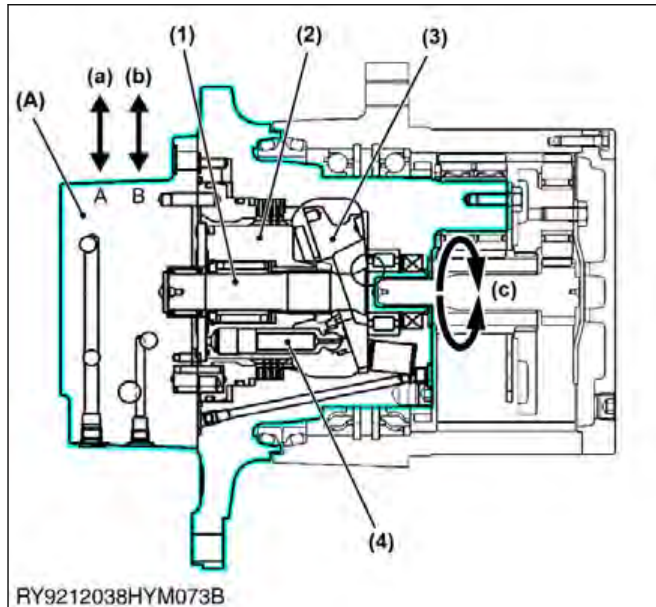
- | | | |
|--------------------|----------------------------------|---------------------|
| (1) Swash plate | (4) Travel speed shift valve | (7) Flushing valve |
| (2) Control piston | (5) High pressure selector valve | (A) Hydraulic motor |
| (3) Parking brake | (6) Flushing relief valve | (B) Reduction gear |

5.3 HST motor function and structure

5.3.1 HST motor working principles

Converts hydraulic energy to rotating power. Composed of the hydraulic motor and the reduction gear.

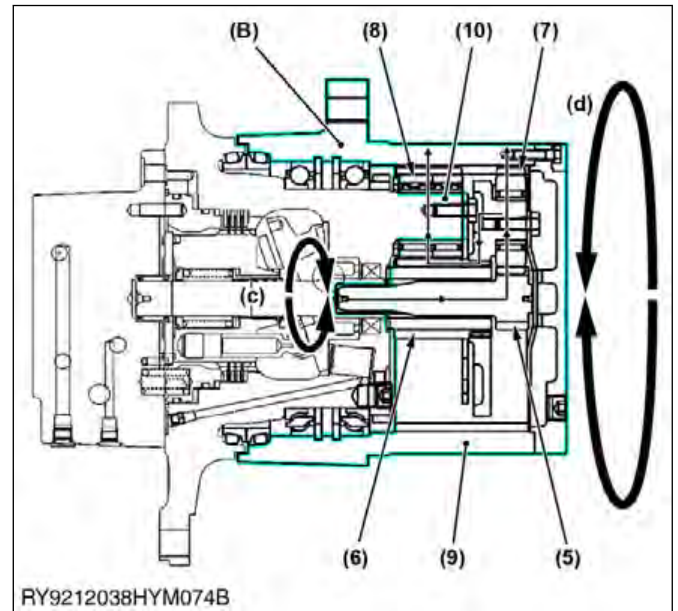
Hydraulic motor



- | | |
|--------------------|--------------------------|
| (1) Shaft | (a) Suction or discharge |
| (2) Cylinder block | (b) Suction or discharge |
| (3) Swash plate | (c) Shaft's rotation |
| (4) Piston | (A) Hydraulic motor |

- The pressurized oil from the HST pump flows into the port A or B.
- The pressurized oil flows into the pistons, and the cylinder block rotates.
- The cylinder block is connected to the shaft, so the rotation of the shaft is transmitted to the reduction gear.
- The oil inside of the piston is discharged from the port A or B, and returns to the HST pump.

Reduction gear

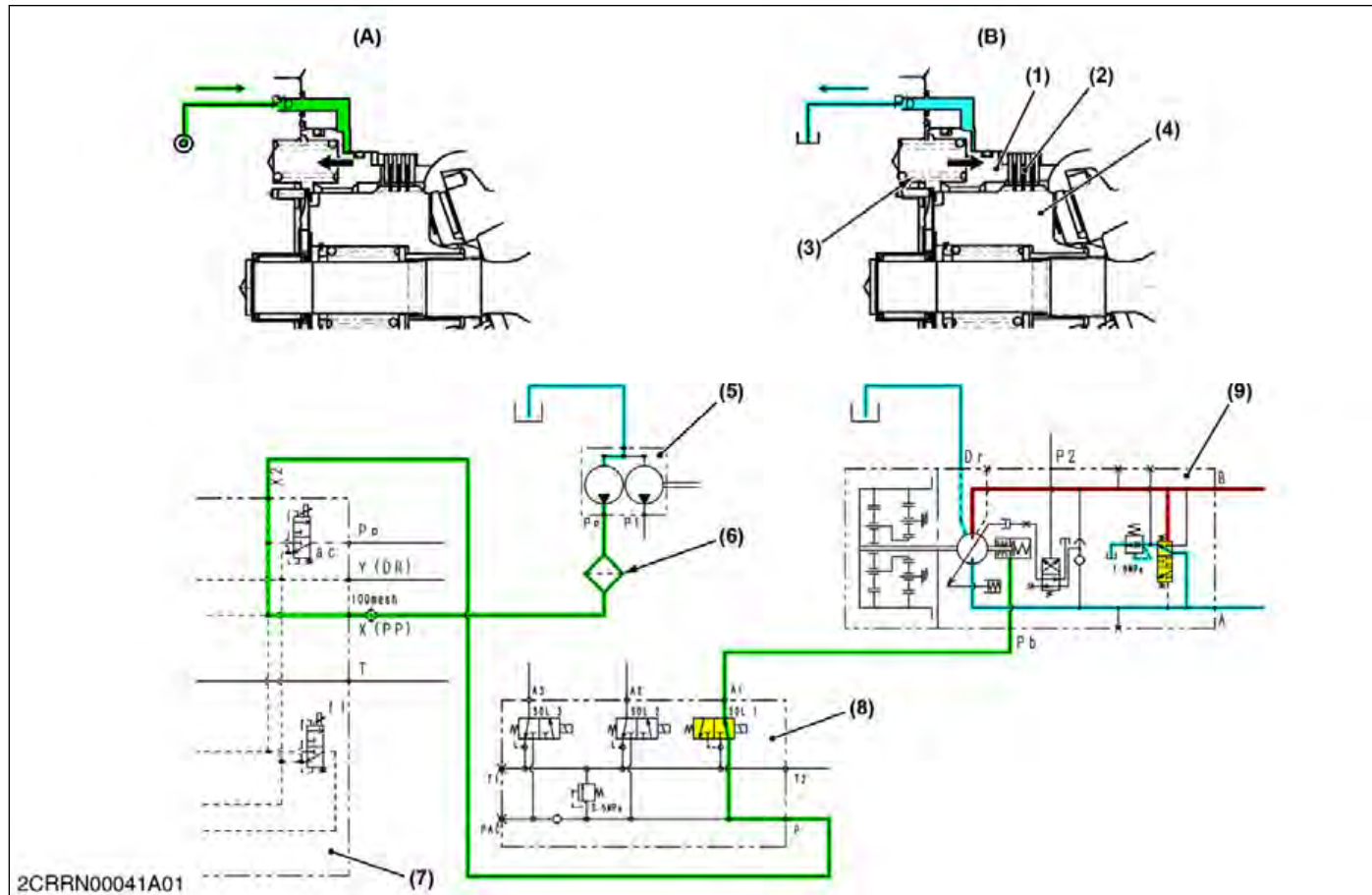


- | | |
|---------------------------|---------------------------|
| (5) First sun gear | (10) Motor housing |
| (6) Second sun gear | (c) Rotation of the shaft |
| (7) First planetary gear | (d) Rotation of traveling |
| (8) Second planetary gear | (B) Reduction gear |
| (9) Ring gear | |

- The gears convert the rotation of the shaft to that of HST motor.
 - The first sun gear rotates according to the hydraulic motor rotation, and drives the first planetary gears.
 - The first planetary gears rotate the ring gear, as the first planetary gears are meshed with the ring gear.
 - The second sun gear rotates according to the hydraulic motor rotation, and drives the second planetary gears.
 - The second planetary gears output the torque to the ring gear, as the second planetary gears are connected to the motor housing, which does not rotate.
- The direction of the rotation of the shaft is opposite to that of HST motor.

5.3.2 Parking brake

Holds the HST motor not to rotate.



- | | | | |
|--------------------|-------------------|---------------------------------------|--|
| (1) Brake piston | (5) Gear pump | (9) HST motor | (B) When the parking brake is released |
| (2) Friction plate | (6) HST filter | (A) When the parking brake is engaged | |
| (3) Brake spring | (7) Control valve | | |
| (4) Cylinder block | (8) Unload valve | | |

When the parking brake is engaged

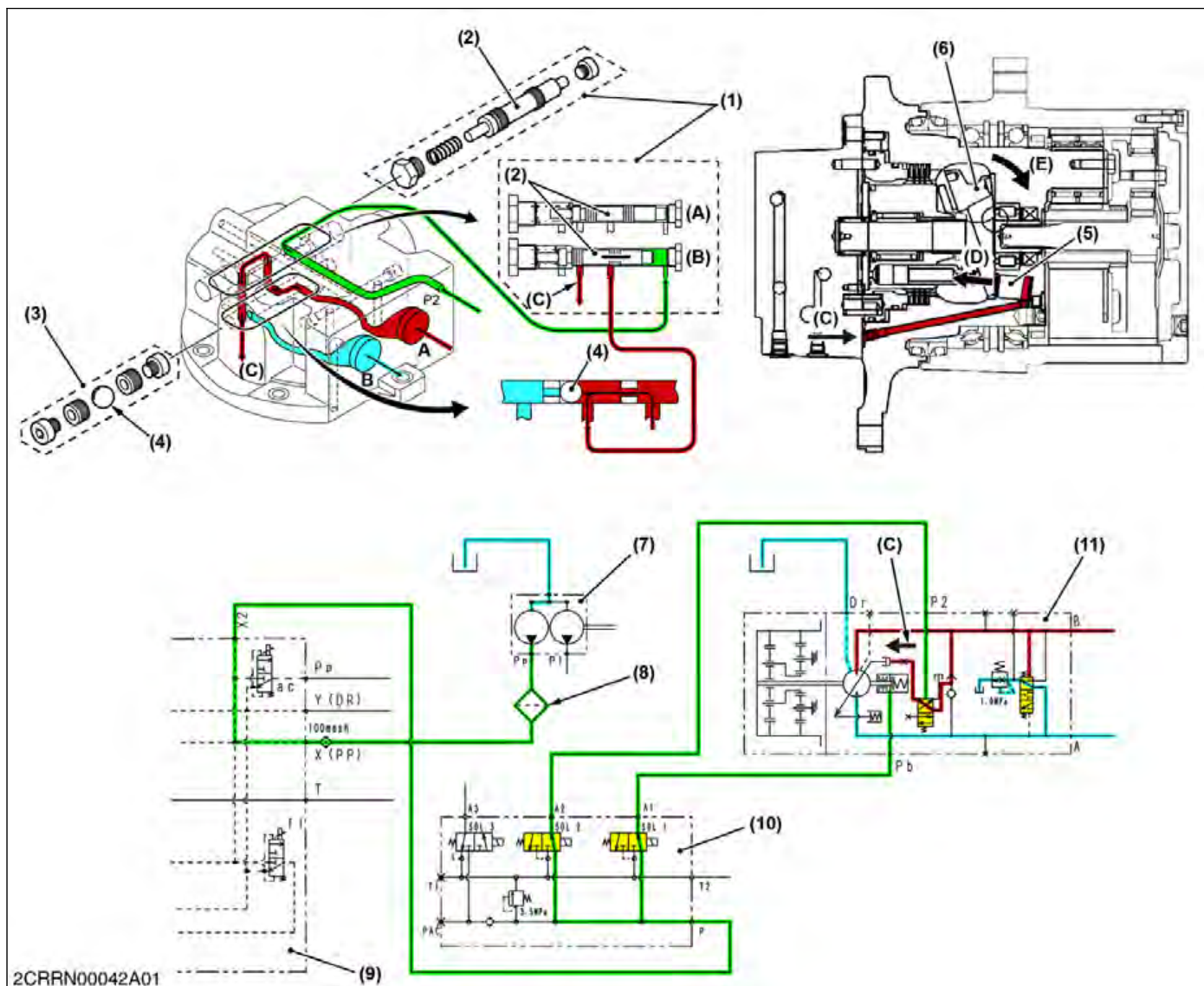
- The brake piston presses the friction plates by the brake spring.
- The friction plates hold the cylinder block not to rotate, as the friction plates are meshed to the cylinder block.
- The HST motor does not rotate even if the machine is operated to travel.

When the parking brake is released

- When the parking brake switch is pressed, the parking brake solenoid turns on.
- The pressurized oil from the charge pump flows to the brake piston, and detaches the brake piston from the friction plates.
- The cylinder block is disengaged from the friction plates, and the HST motor becomes able to rotate.

5.3.3 Travel speed shift

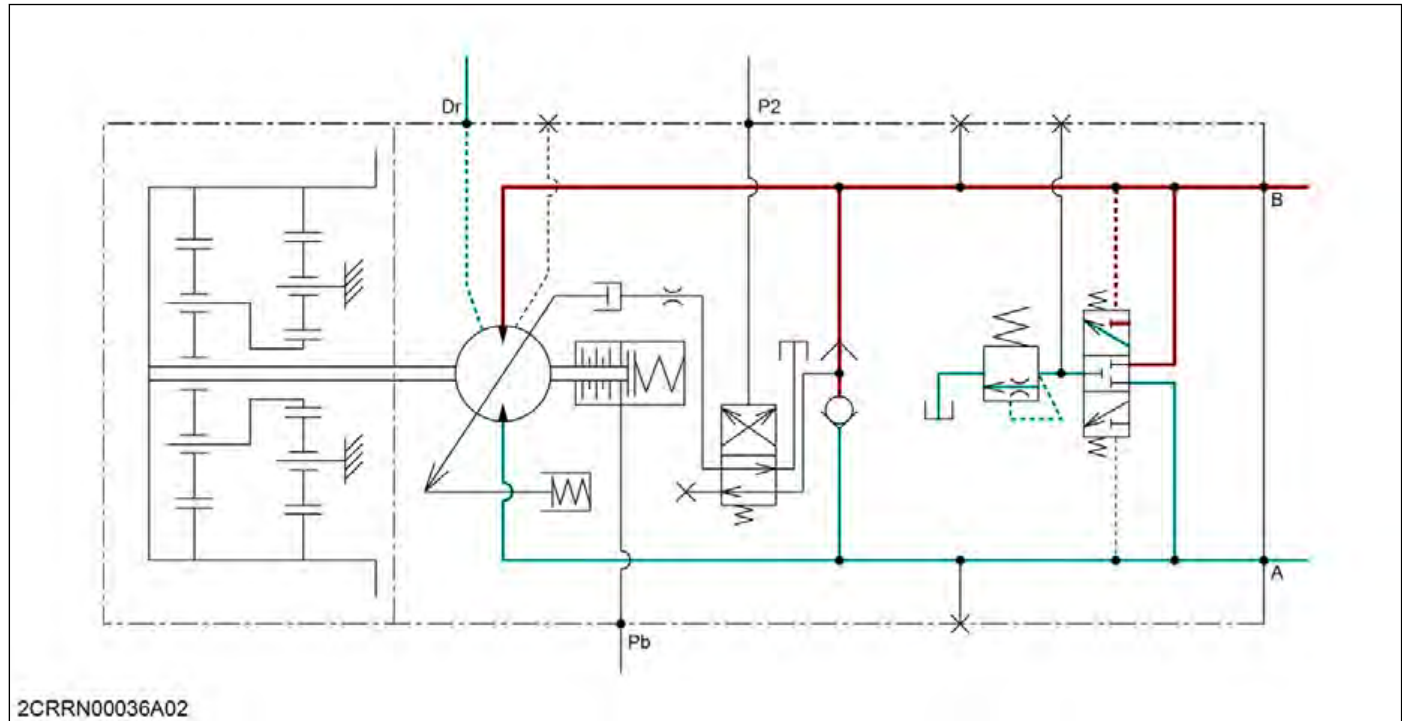
Shifts the travel speed from low speed to high speed.



- | | | | |
|----------------------------------|-------------------|---------------------------------|---------------------------------------|
| (1) Travel speed shift valve | (6) Swash plate | (11) HST motor | (D) Pressing force to the swash plate |
| (2) Spool | (7) Gear pump | (A) When high speed | (E) Swash plate movement |
| (3) High pressure selector valve | (8) HST filter | (B) When low speed | |
| (4) Ball | (9) Control valve | (C) Travel speed shift pressure | |
| (5) Control piston | (10) Unload valve | | |

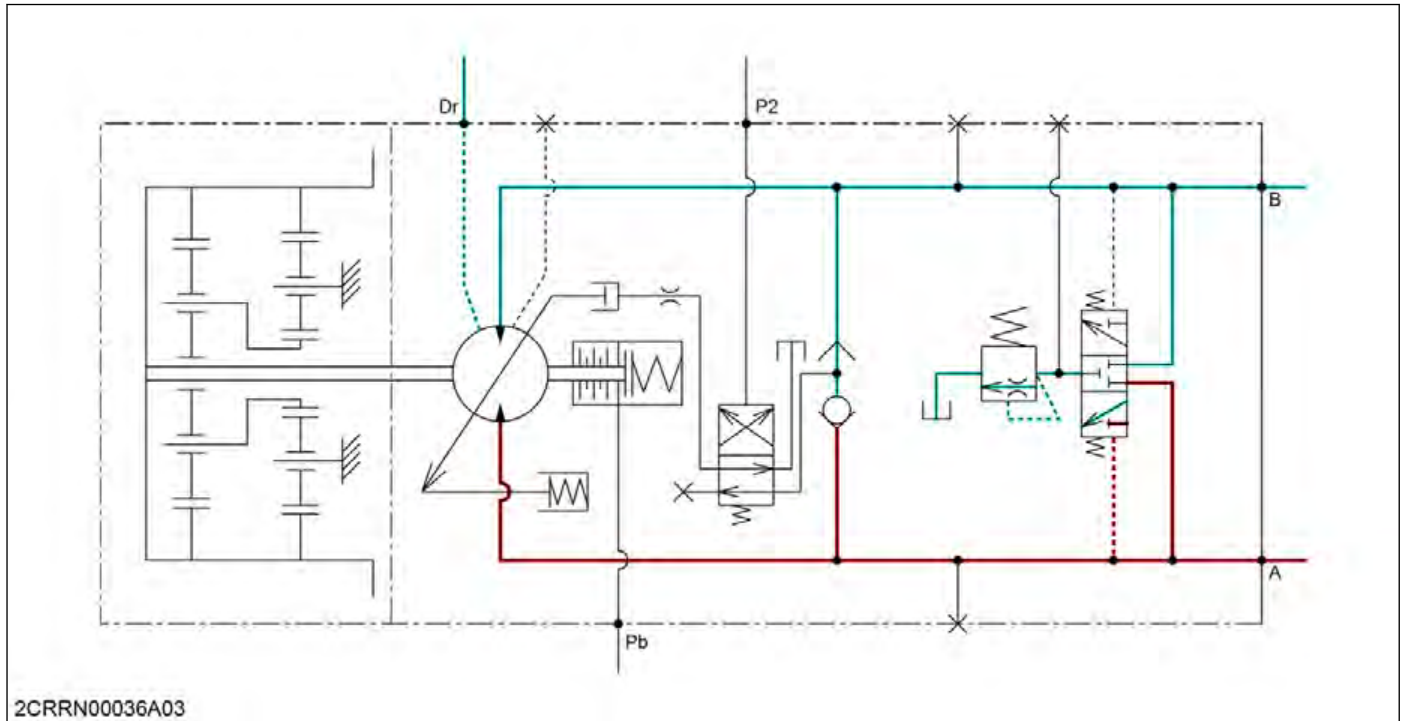
- When the travel speed shift switch is pressed, the pressurized oil from the charge pump flows into the port P2.
- The pressurized oil from the charge pump flows into the travel speed shift valve, and presses the spool left.
- The pressurized oil from the HST pump presses the ball to enter the travel speed shift valve, and flows to the control piston.
- The control piston is pressed by the pressurized oil, and presses the swash plate.
- The swash plate angle is minimized. The travel speed gets increased and the torque gets decreased.

5.3.4 Forward traveling circuit



- When the travel control lever is in forward traveling position, the pressurized oil from the HST pump flows into the HST motor.
 - HST motor RH : the pressurized oil flows into port B, as shown in the above figure.
 - HST motor LH : the direction of oil flow is opposite to the RH.
- The high pressure oil rotates the HST motor.
- The hydraulic oil returns to the HST pump from port A.

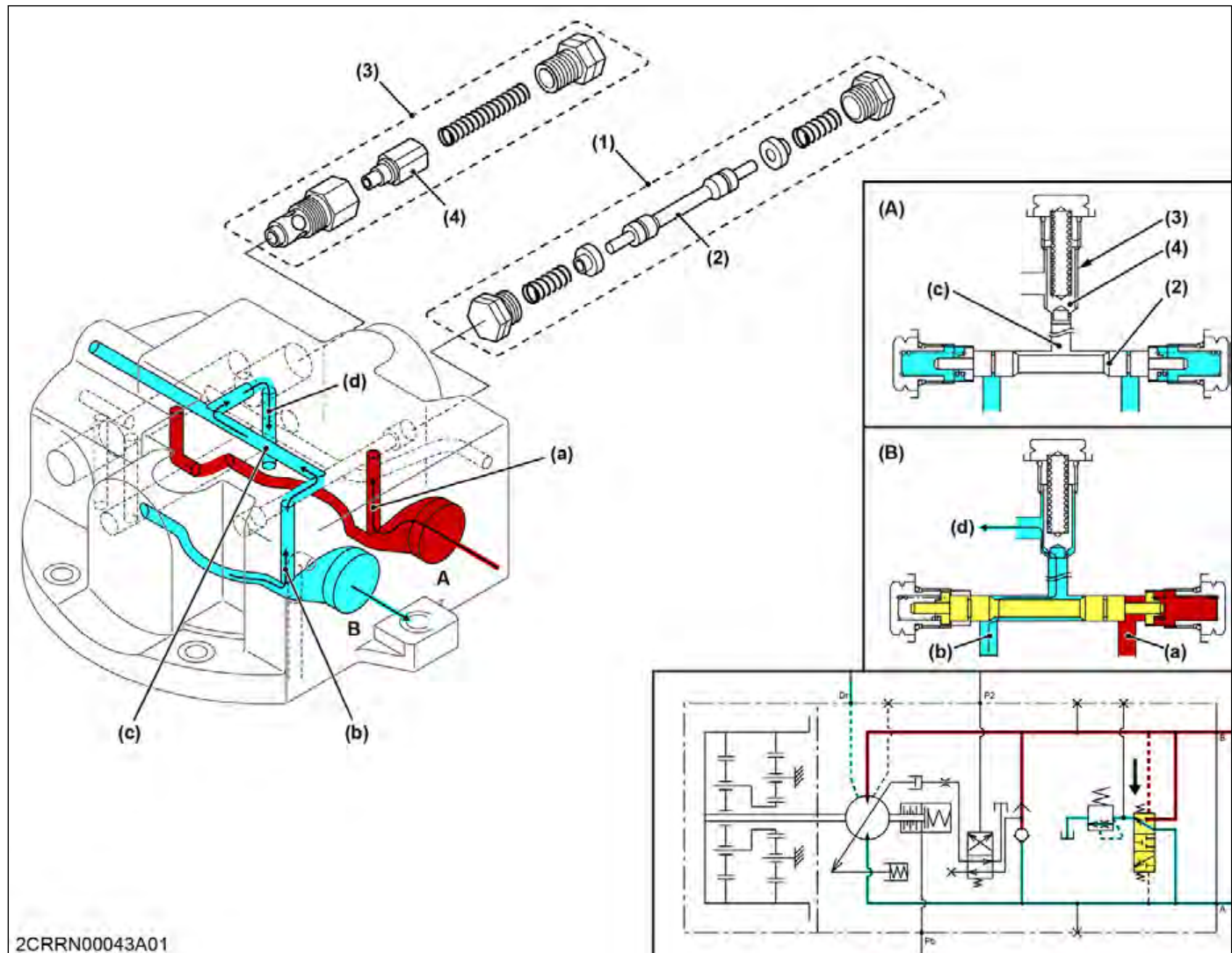
5.3.5 Backward traveling circuit



- When the travel control lever is in backward traveling position, the pressurized oil from the HST pump flows into the HST motor.
 - HST motor RH : the pressurized oil flows into port A, as shown in the above figure.
 - HST motor LH : the direction of oil flow is opposite to the RH.
- The high pressure oil rotates the HST motor.
- The hydraulic oil returns to the HST pump from port B.

5.3.6 Flushing

Returns the hydraulic oil in the HST closed circuit to the hydraulic oil tank, to lower the oil temperature and remove the contamination.



(1) Flushing valve

(4) Poppet

(b) HST low pressure oil passage

(A) When not traveling

(2) Spool

(a) HST high pressure oil pas-

(B) When traveling

(3) Flushing relief valve

sage

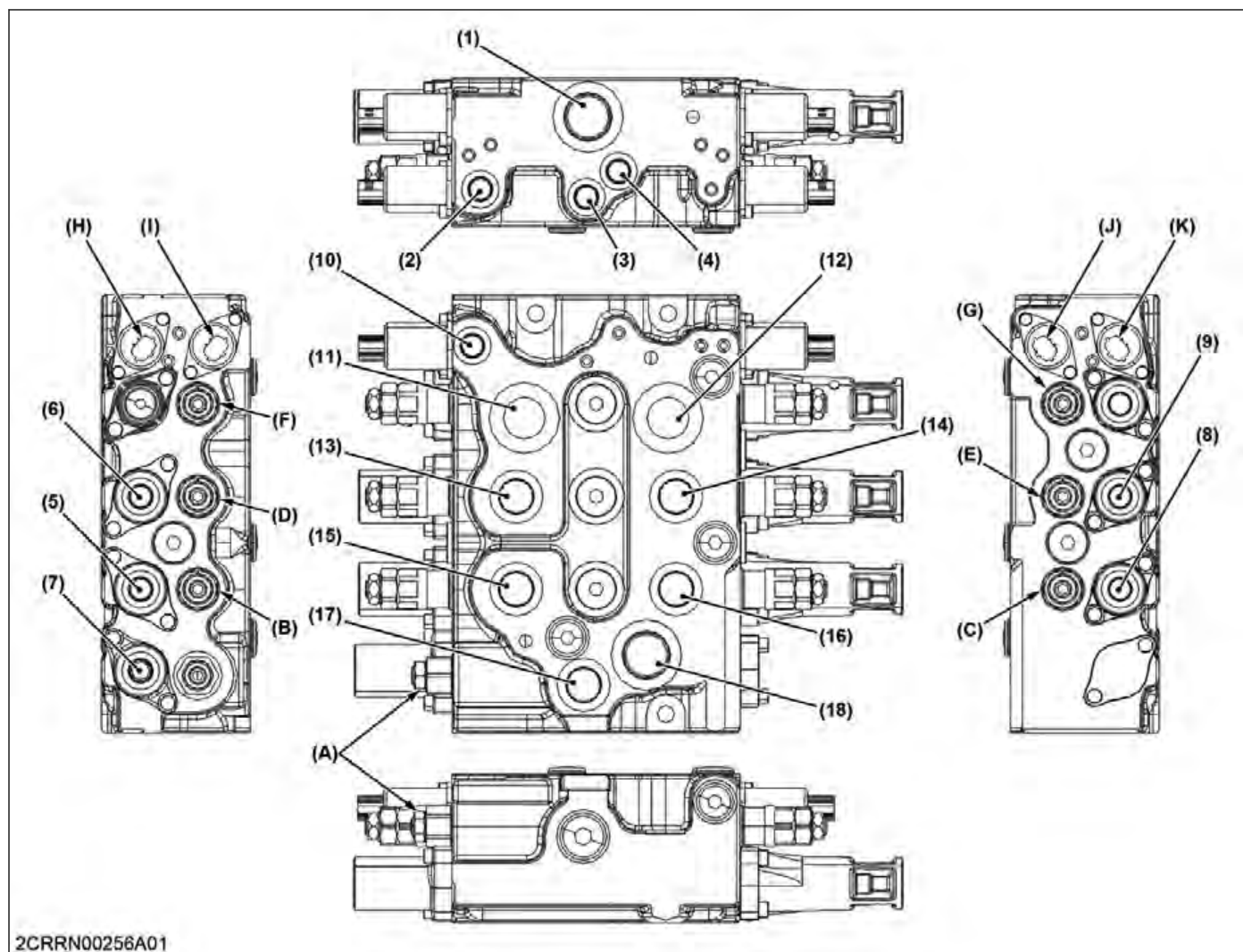
(c) Flushing relief oil passage

(d) To the hydraulic oil tank

- The HST high pressure oil flows into the flushing valve, and presses the spool.
- The HST low pressure oil also flows into the flushing valve, and opens the flushing relief valve.
- The HST low pressure oil returns to the hydraulic oil tank through the flushing relief valve.

6. Control valve

6.1 Control valve specifications



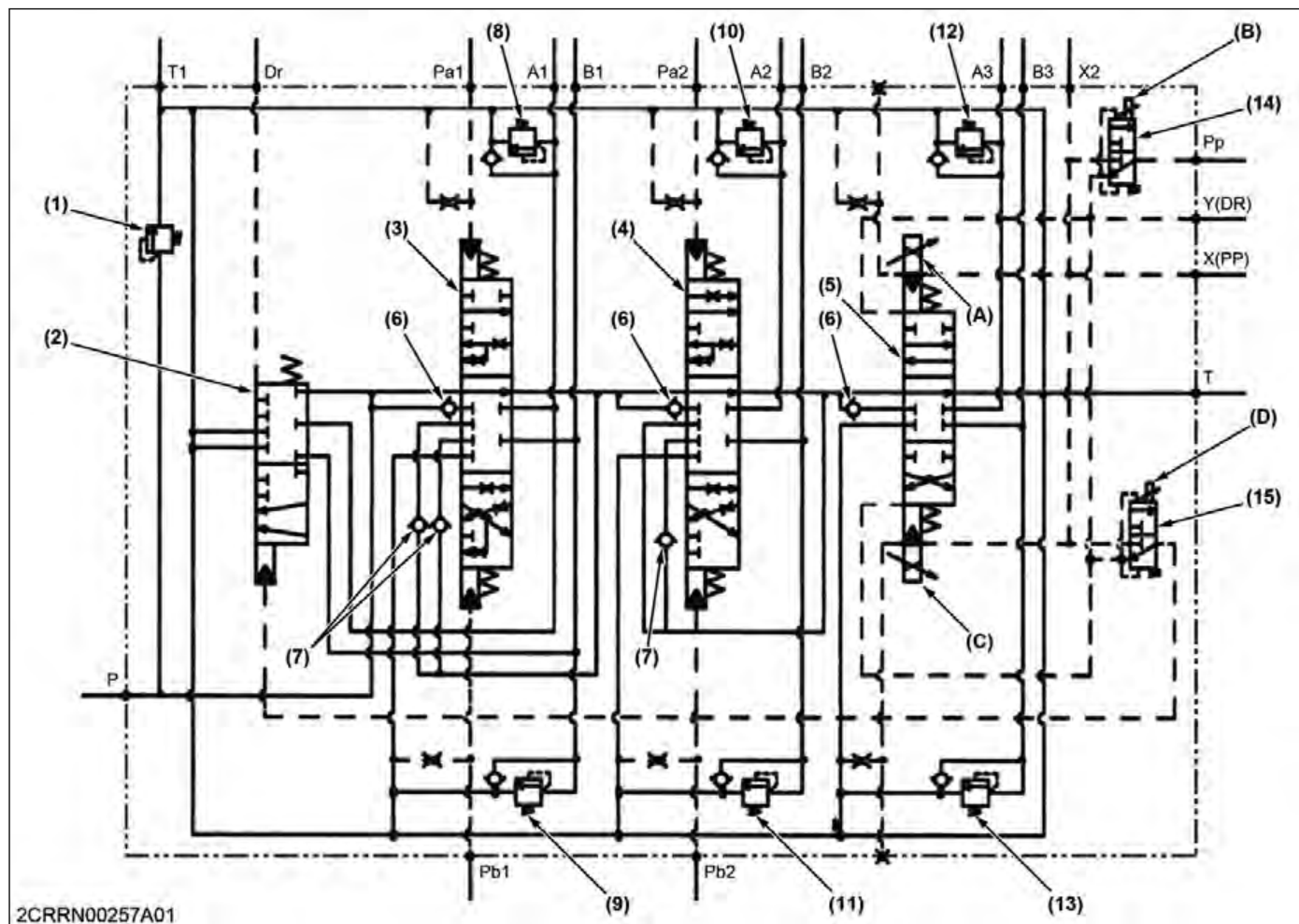
- | | | | |
|---------------------------------|---------------------------------|--|--|
| (A) Main relief valve (aP1) | (E) Overload relief valve (b2B) | (H) Proportional solenoid 1 (AUX female) | (J) Proportional solenoid 3 (AUX male) |
| (B) Overload relief valve (b1B) | (F) Overload relief valve (b3F) | (I) Proportional solenoid 2 (anti-stall) | (K) Proportional solenoid 4 (float) |
| (C) Overload relief valve (b1R) | (G) Overload relief valve (b3M) | | |
| (D) Overload relief valve (b2R) | | | |

	Specifications	Remarks
Manufacturer	KYB corporation	—
Model	GZ-MS-V0165	—
Main relief valve setting pressure	22.5 MPa 229 kgf/cm ² 3260 psi	At 78.8 L/min At 20.8 U.S.gals/min
Overload relief valve setting pressure	26.5 MPa 270 kgf/cm ² 3840 psi	At 5.0 L/min At 1.3 U.S.gals/min

Port location table

No.	Port	Location	No.	Port	Location
(1)	Port T	Hydraulic oil tank	(10)	Port X2	Unload valve (port P)
(2)	Port Pp	Travel control valve (port P)	(11)	Port A3	AUX outlet port (female)
(3)	Port Y(DR)	Hydraulic oil tank	(12)	Port B3	AUX outlet port (male)
(4)	Port X(PP)	HST filter Supply of the hydraulic oil from the charge pump	(13)	Port A2	Bucket cylinder (rod) and self-leveling solenoid valve (port C) Bucket crowding
(5)	Port Pa1	Front attachment control valve (port 4) Lift arm raising	(14)	Port B2	Bucket cylinder (bottom) and self-leveling solenoid valve (port D) Bucket dumping
(6)	Port Pa2	Front attachment control valve (port 1) Bucket crowding	(15)	Port A1	Lift arm cylinder (bottom) Lift arm raising
(7)	Port Dr	Hydraulic oil tank	(16)	Port B1	Self-leveling solenoid valve (port B) Lift arm lowering
(8)	Port Pb1	Front attachment control valve (port 2) Lift arm lowering	(17)	Port P	Main pump
(9)	Port Pb2	Front attachment control valve (port 3) Bucket dumping	(18)	Port T1	Oil cooler

6.2 Control valve hydraulic circuit



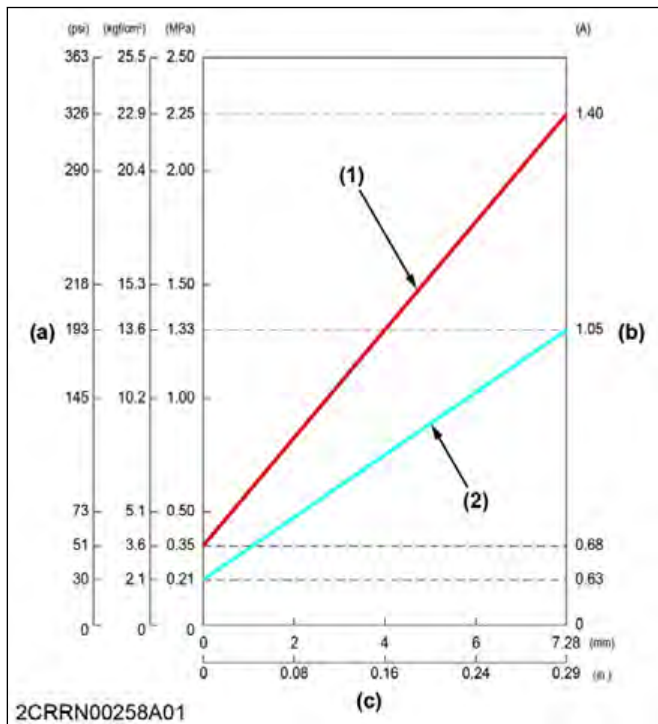
- (1) Main relief valve (aP1)
- (2) Float section spool
- (3) Lift arm section spool
- (4) Bucket section spool
- (5) AUX section spool
- (6) Load check valve

- (7) Series check valve
- (8) Overload relief valve (b1B)
- (9) Overload relief valve (b1R)
- (10) Overload relief valve (b2R)
- (11) Overload relief valve (b2B)
- (12) Overload relief valve (b3F)

- (13) Overload relief valve (b1M)
- (14) Proportional solenoid valve (travel pilot pressure control)
- (15) Proportional solenoid valve (float)

- (A) Proportional solenoid 1 (AUX female)
- (B) Proportional solenoid 2 (anti-stall)
- (C) Proportional solenoid 3 (AUX male)
- (D) Proportional solenoid 4 (float)

6.3 Control valve spool shift performance



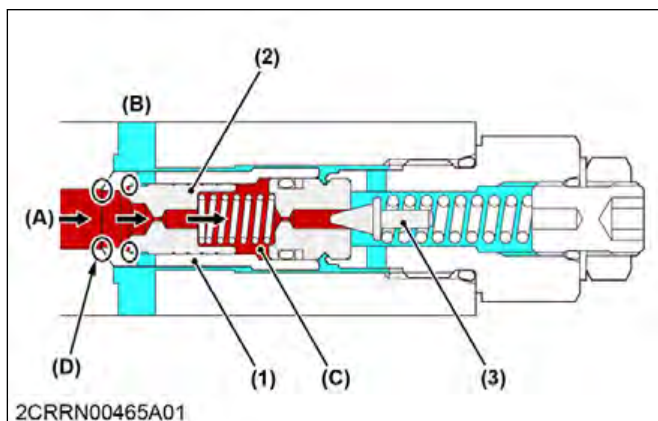
- (1) Operating pressure
(2) Operating pressure (float spool)
(a) Pilot pressure
(b) Electric current
(c) Spool stroke

6.4 Control valve function and structure

6.4.1 Main relief valve

Prevents surge pressure in the hydraulic circuit.

When not relieving (working pressure < set pressure)

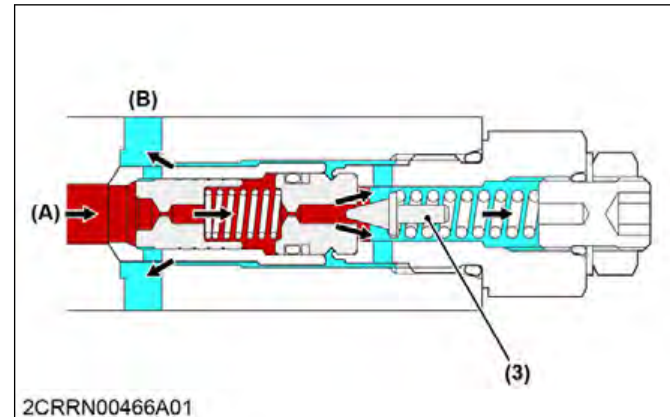


- (1) Sleeve
(2) Main poppet
(3) Pilot poppet
(A) High pressure circuit
(B) Low pressure circuit
(C) Space A
(D) Seating point

- The space A is filled with the hydraulic oil through the main poppet.
- The sleeve seats on the main poppet securely.

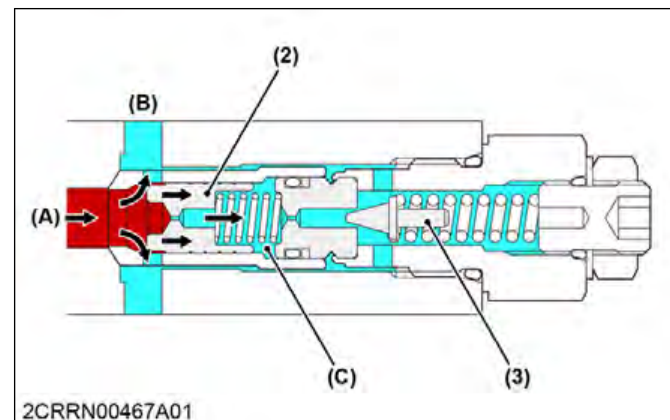
- The main relief valve does not relieve the hydraulic oil as the pilot poppet is not moved.

When relieving (working pressure > set pressure)



- (3) Pilot poppet
(A) High pressure circuit
(B) Low pressure circuit

- The pressurized oil in the high pressure circuit opens the pilot poppet.
- The hydraulic oil flows to the low pressure circuit.



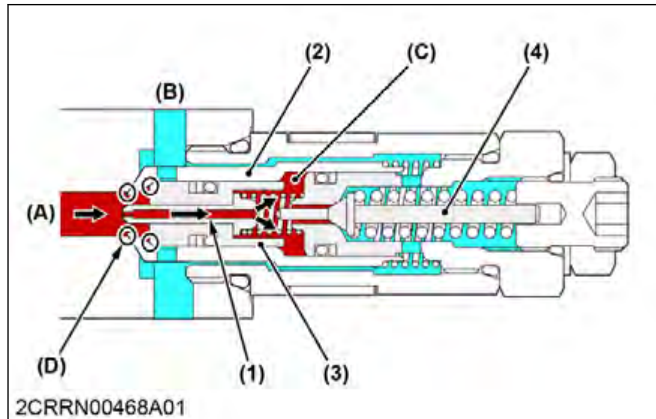
- (2) Main poppet
(3) Pilot poppet
(A) High pressure circuit
(B) Low pressure circuit
(C) Space A

- The opening of the pilot poppet causes the pressure decrease in the space A.
- The main poppet opens, and the hydraulic oil in the high pressure circuit flows to the low pressure circuit directly.

6.4.2 Overload relief valve

Releases the hydraulic oil in the case of overload.
Provides the hydraulic oil in the case of negative pressure.

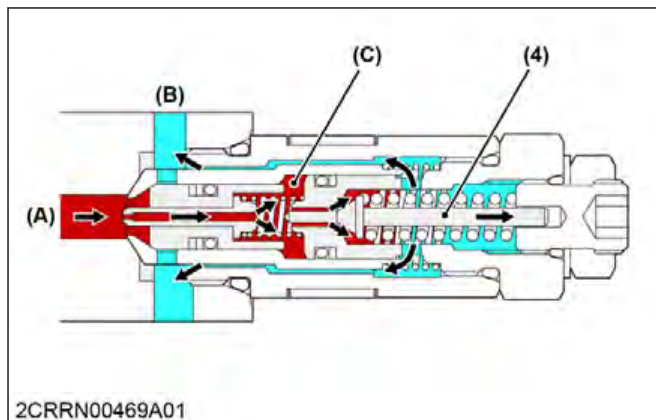
When not relieving (working pressure < setting pressure)



- | | |
|------------------|---------------------------|
| (1) Piston | (A) High pressure circuit |
| (2) Sleeve | (B) Low pressure circuit |
| (3) Main poppet | (C) Space A |
| (4) Pilot poppet | (D) Seating point |

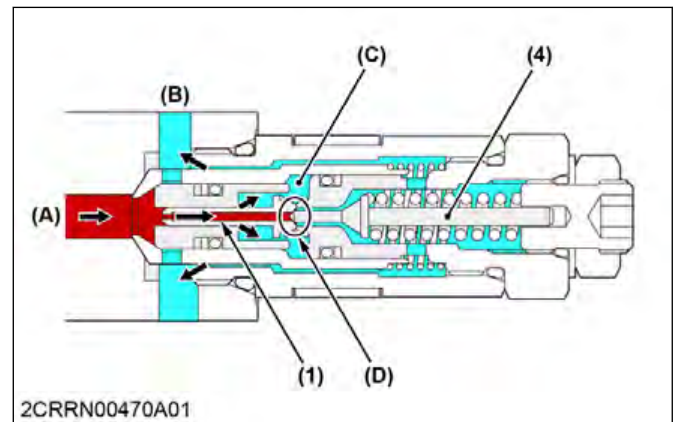
- The space A is filled with the hydraulic oil through the piston.
- The sleeve is not seated to the main poppet securely.
- The overload relief valve does not relieve the hydraulic oil as the pilot poppet is not moved.

When relieving (working pressure > set pressure)



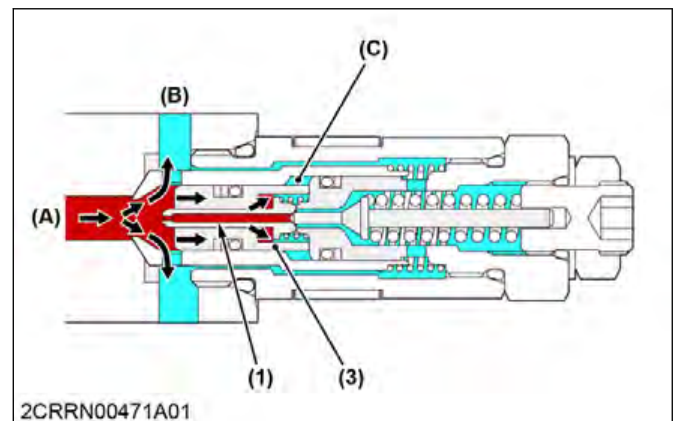
- | | |
|---------------------------|--------------------------|
| (4) Pilot poppet | (B) Low pressure circuit |
| (A) High pressure circuit | (C) Space A |

- The pressurized oil in the high pressure circuit opens the pilot poppet.
- The hydraulic oil in the space A flows to the low pressure circuit.



- | | |
|---------------------------|--------------------------|
| (1) Piston | (B) Low pressure circuit |
| (4) Pilot poppet | (C) Space A |
| (A) High pressure circuit | (D) Seating point |

- The opening of the pilot poppet causes the pressure decrease in the space A.
- The piston moves right, and seats on the pilot poppet.

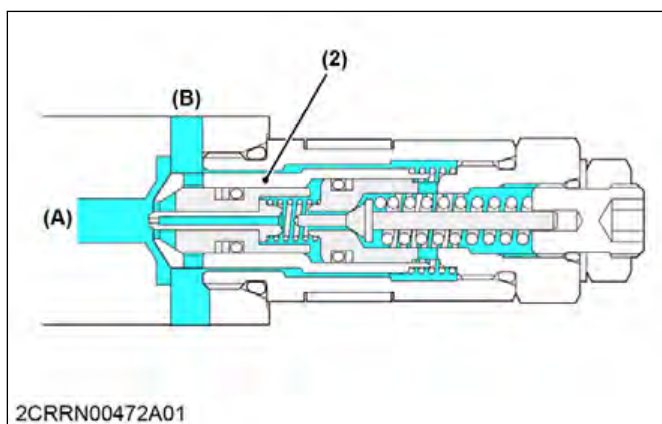


- | | |
|---------------------------|--------------------------|
| (1) Piston | (B) Low pressure circuit |
| (3) Main poppet | (C) Space A |
| (A) High pressure circuit | |

- The pressure difference between the high pressure circuit and the space A increases.
- The main poppet opens, and the hydraulic oil in the high pressure circuit flows to the low pressure circuit directly.

When make-up

The overload relief valve provides the hydraulic oil when the pressure in the high pressure circuit becomes negative.

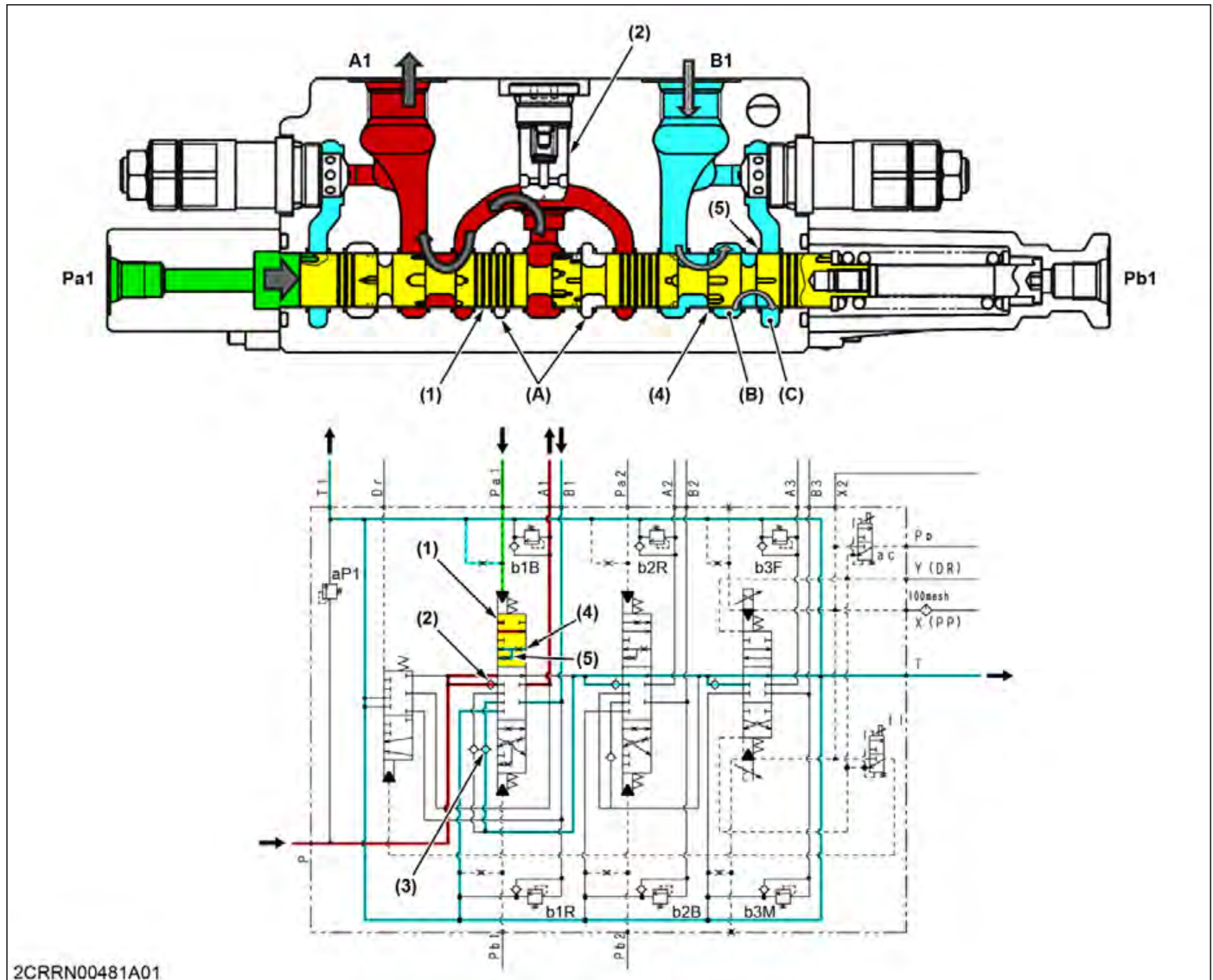


- (2) Sleeve (B) Low pressure circuit
(A) High pressure circuit

- When the pressure in the low pressure circuit becomes higher than that in the high pressure circuit, the sleeve opens.
- The hydraulic oil in the low pressure circuit flows to the high pressure circuit.

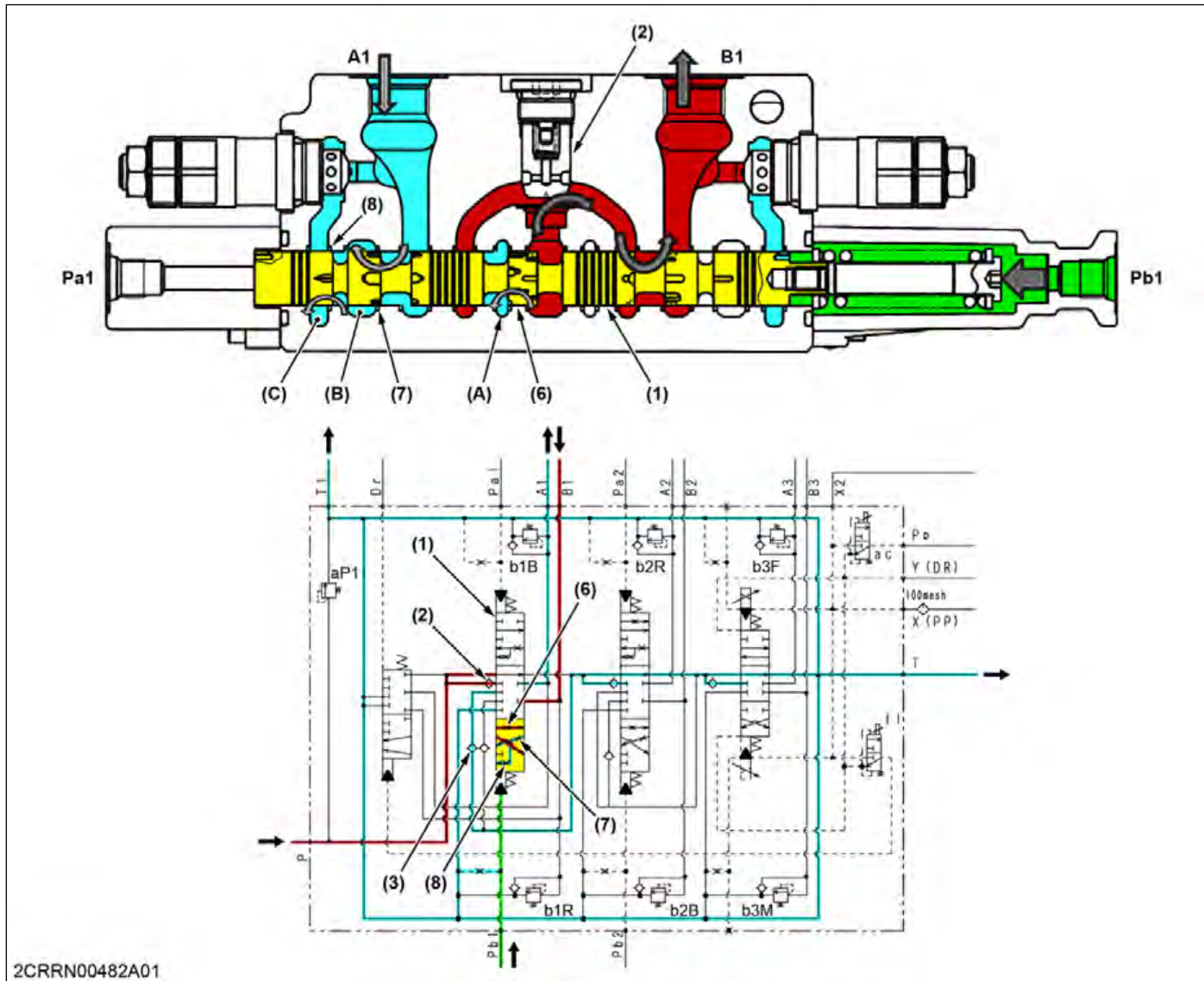
6.4.3 Lift arm operation circuit

When raising the lift arm



- | | | | |
|----------------------|------------------------|--------------------|--------------------------------|
| (1) Spool | (3) Series check valve | (5) Orifice 2 | (B) To the series check valve |
| (2) Load check valve | (4) Orifice 1 | (A) Center passage | (C) Hydraulic oil tank circuit |

- The hydraulic oil from the charge pump flows into the port Pa1.
- The spool is pressed right, and the center passage closes.
- The hydraulic oil from the main pump presses the load check valve up, and flows out to the port A1.
- The hydraulic oil flows back to the port B1, and separated into the 2 circuits.
 - One oil flow passes through the orifice 1. The oil flows to the series check valve and returns to the center passage.
 - The other passes through the orifice 1 and 2. The oil flows to the hydraulic oil tank circuit.

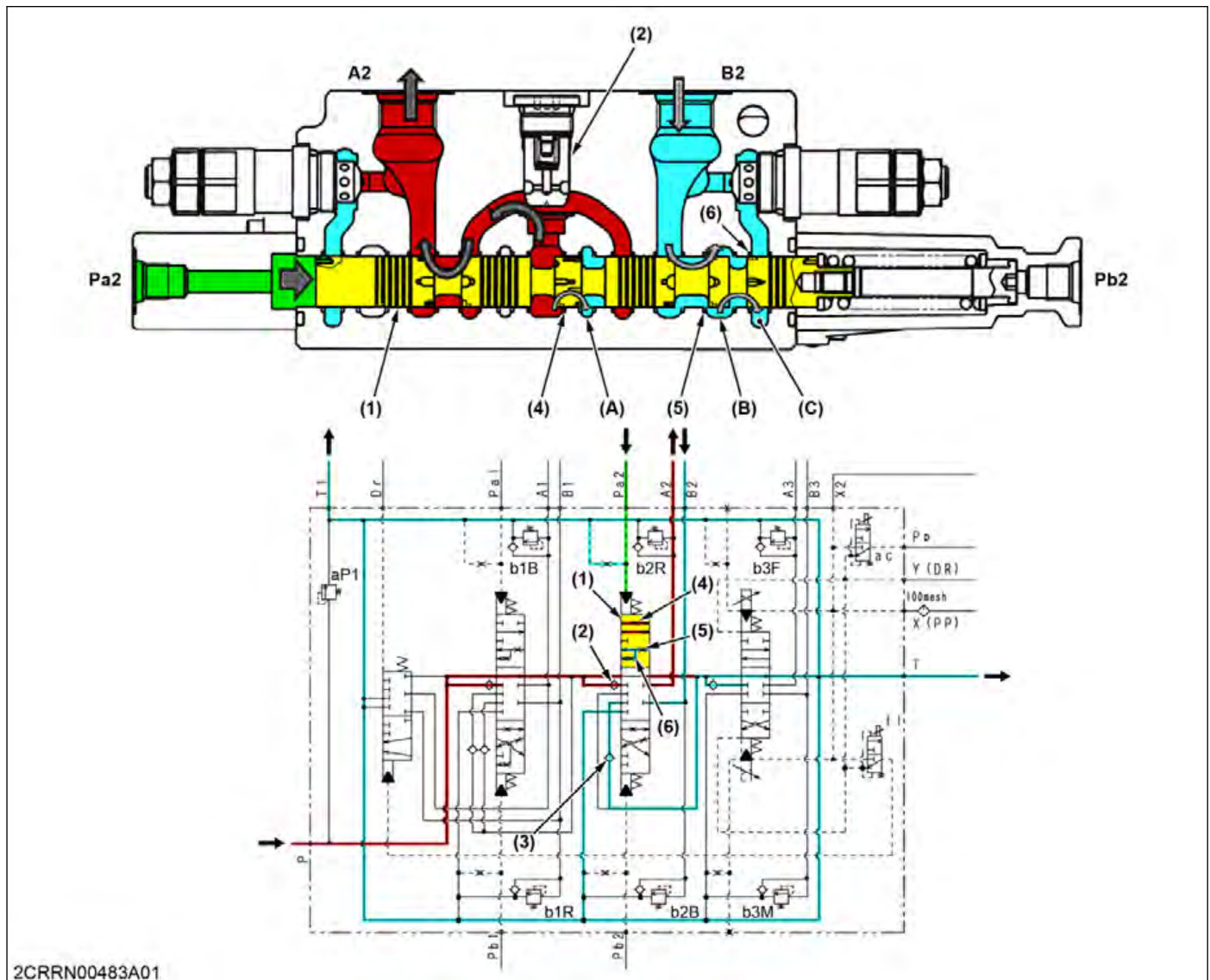
When lowering the lift arm

- | | | |
|------------------------|---------------|--------------------------------|
| (1) Spool | (6) PT notch | (A) Center passage |
| (2) Load check valve | (7) Orifice 3 | (B) To the series check valve |
| (3) Series check valve | (8) Orifice 4 | (C) Hydraulic oil tank circuit |

- The hydraulic oil from the charge pump flows into the port Pb1, and presses the spool left.
- The hydraulic oil from the main pump is separated into the 2 circuits.
 - One oil flow presses the load check valve up, and goes to the port B1.
 - The other flows to the center passage through the PT notch.
- The hydraulic oil flows back to the port A1, and separated into the 2 circuits.
 - One oil flow passes through the orifice 3. The oil flows to the series check valve and returns to the center passage.
 - The other passes through the orifice 3 and 4. The oil flows to the hydraulic oil tank circuit.

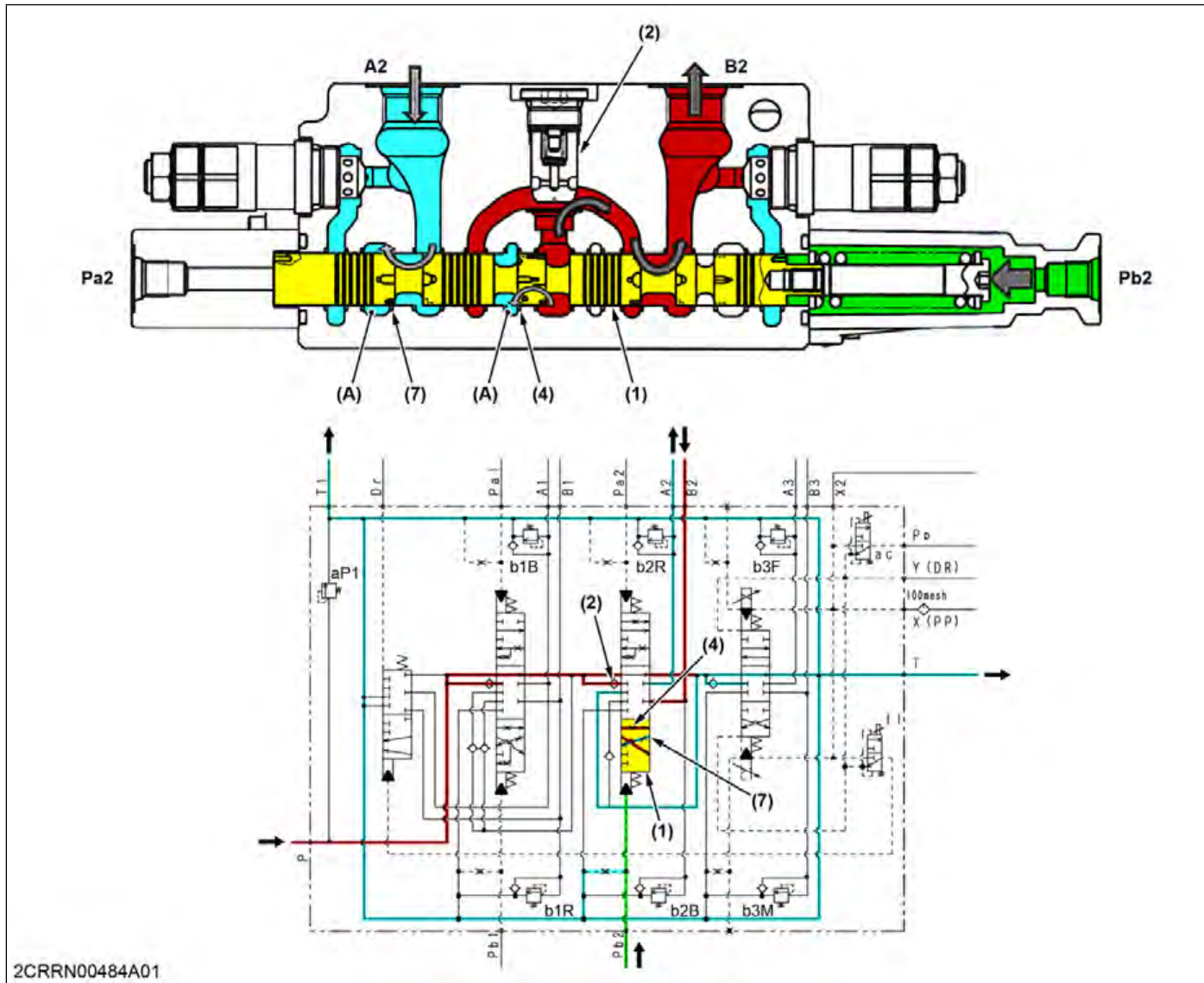
6.4.4 Bucket operation circuit

When the bucket is crowding



- | | | |
|------------------------|---------------|--------------------------------|
| (1) Spool | (4) PT notch | (A) Center passage |
| (2) Load check valve | (5) Orifice 1 | (B) To the series check valve |
| (3) Series check valve | (6) Orifice 2 | (C) Hydraulic oil tank circuit |

- The hydraulic oil from the charge pump flows into the port Pa2, and presses the spool right.
- The hydraulic oil from the main pump is separated into the 2 circuits.
 - One oil flow presses the load check valve up, and goes to the port A2.
 - The other flows to the center passage through the PT notch.
- The hydraulic oil flows back to the port B2, and separated into the 2 circuits.
 - One oil flow passes through the orifice 1. The oil flows to the series check valve and returns to the center passage.
 - The other passes through the orifice 1 and 2. The oil flows to the hydraulic oil tank circuit.

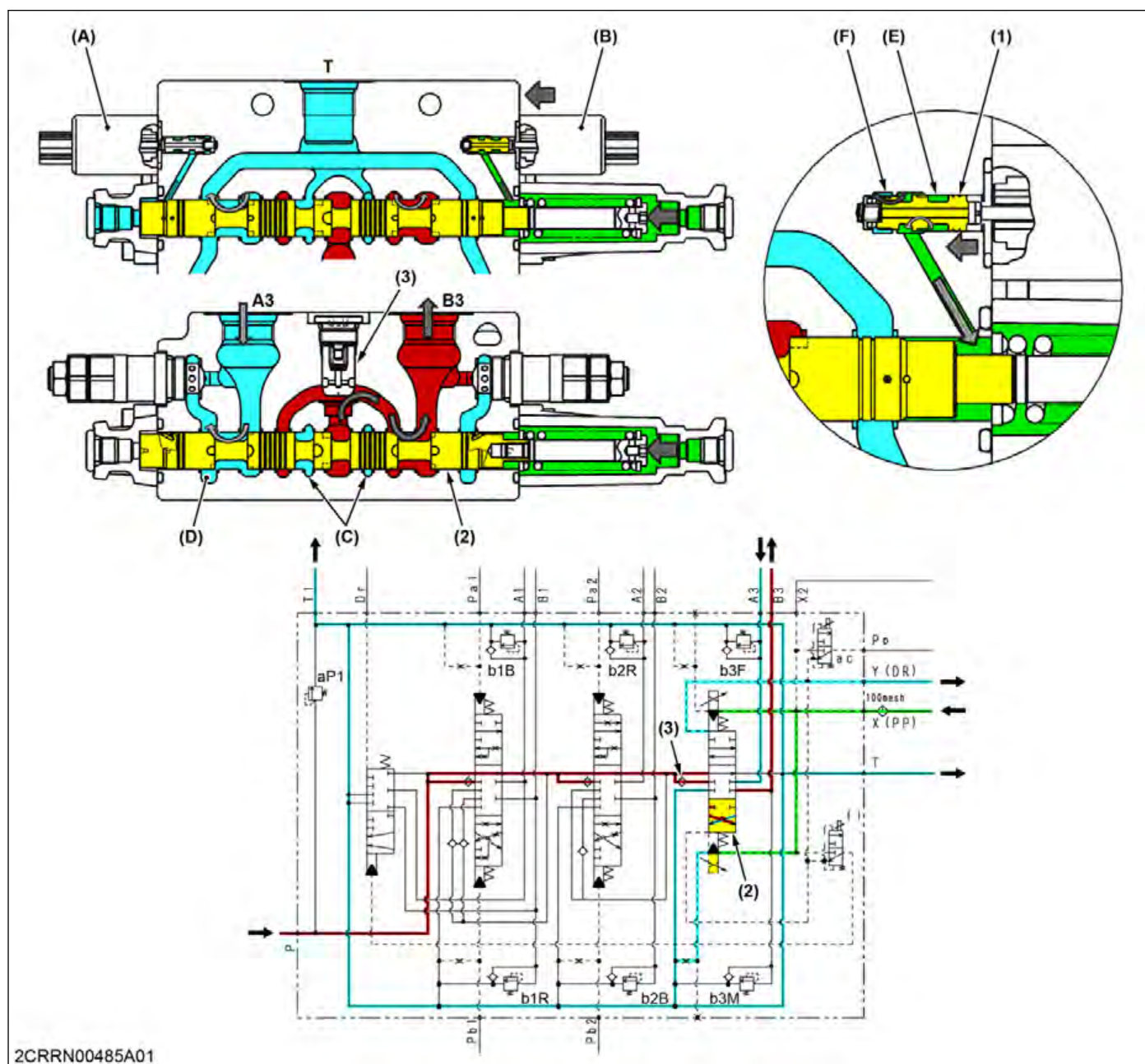
When the bucket is dumping

- (1) Spool
(2) Load check valve
(4) PT notch
(7) Orifice 3
(A) Center passage

- The hydraulic oil from the charge pump flows into the port Pb2, and presses the spool left.
- The hydraulic oil from the main pump is separated into the 2 circuits.
 - One oil flow presses the load check valve up, and goes to the port B2.
 - The other flows to the center passage through the PT notch.
- The hydraulic oil flows back to the port A2, and flows to the center passage through the orifice 3.

6.4.5 AUX operation circuit

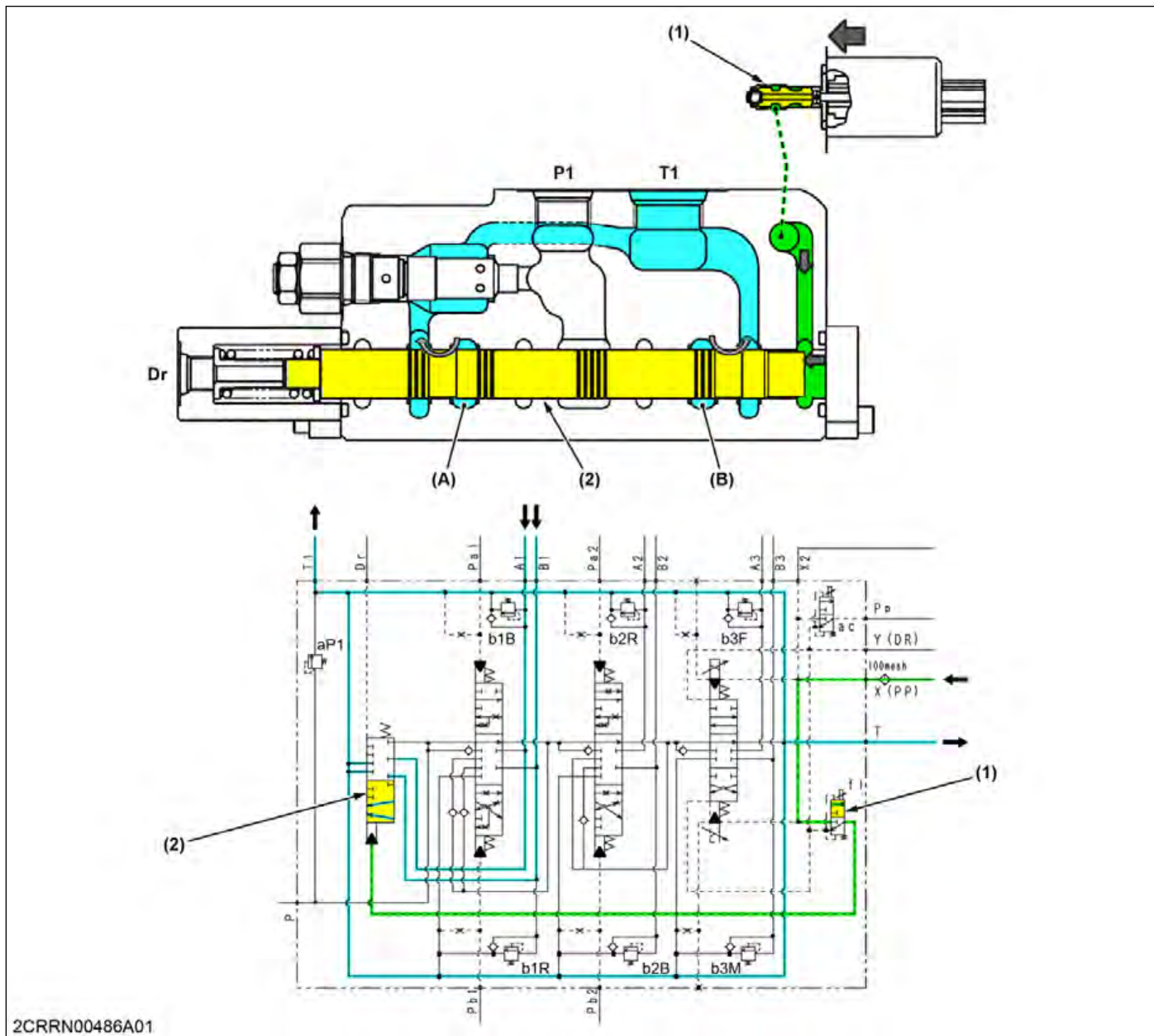
Operating AUX



- | | | |
|----------------------|--------------------|--------------------------------|
| (1) Solenoid spool | (A) Solenoid (a3) | (D) Hydraulic oil tank circuit |
| (2) AUX spool | (B) Solenoid (b3) | (E) From the port X(PP) |
| (3) Load check valve | (C) Center passage | (F) To the port Y(DR) |

- When voltage is applied to the solenoid (b3), the solenoid spool is pressed left.
- The hydraulic oil from the port X(PP) flows to the right side of the AUX spool.
- The AUX spool is pressed left, and the center passage closes.
- The hydraulic oil from the main pump presses the load check valve up, and flows to the port B3.
- The hydraulic oil flows back to the port A3, and flows to the hydraulic oil tank circuit.

6.4.6 Float operation circuit

When float operation is being performed

(1) Solenoid spool

(2) Float spool

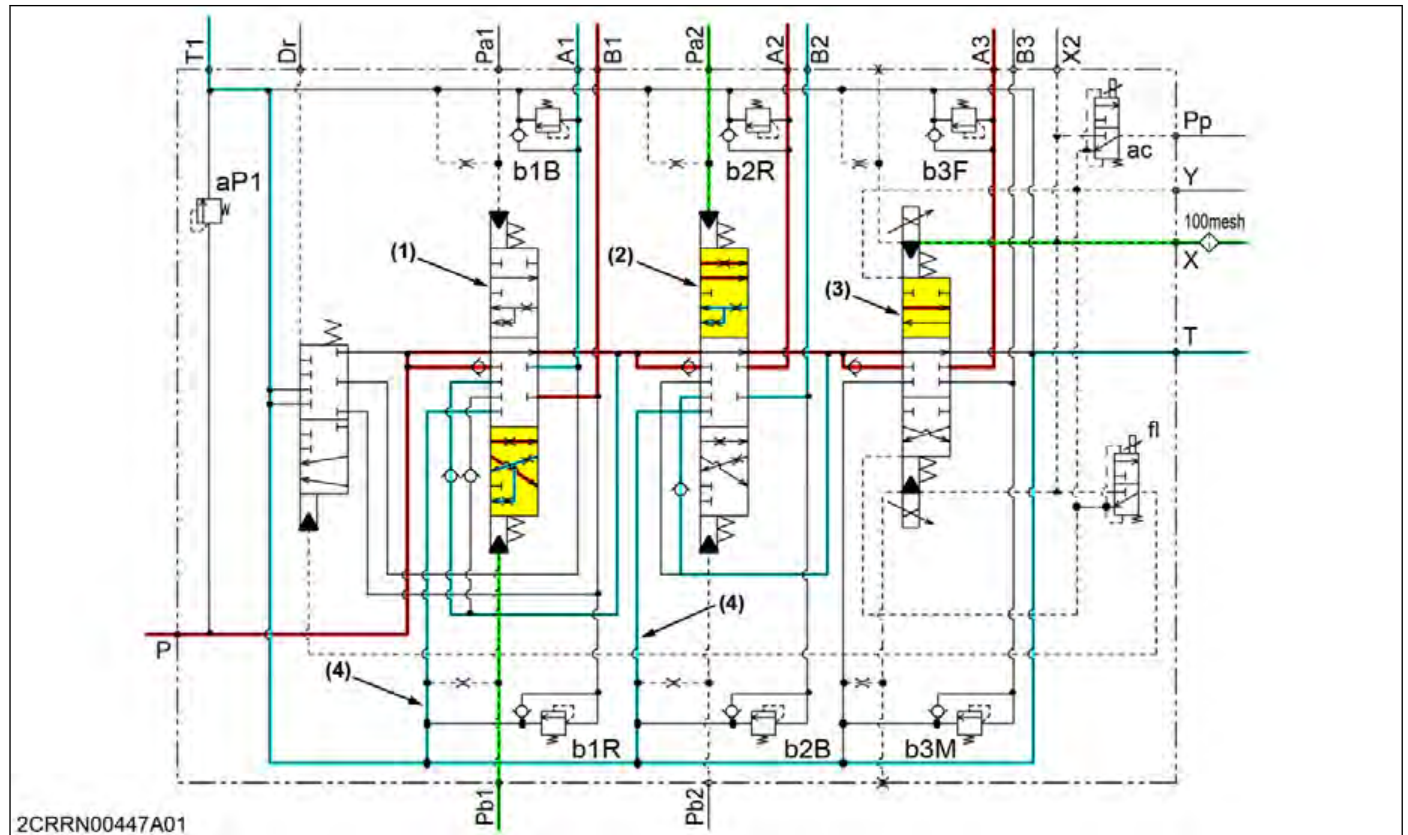
(A) Connected to the port A1

(B) Connected to the port B1

- When voltage is applied to the solenoid (fl), the solenoid spool is pressed left.
- The hydraulic oil from the port X(PP) flows to the right side of the float spool.
- The rod and bottom sides of the lift arm cylinders are connected to the hydraulic oil tank.

6.4.7 Bleed circuit

The bleed circuit enables to operate the lift arm or bucket even when an actuator in the downstream is overloaded.



(1) Lift arm section

(2) Bucket section

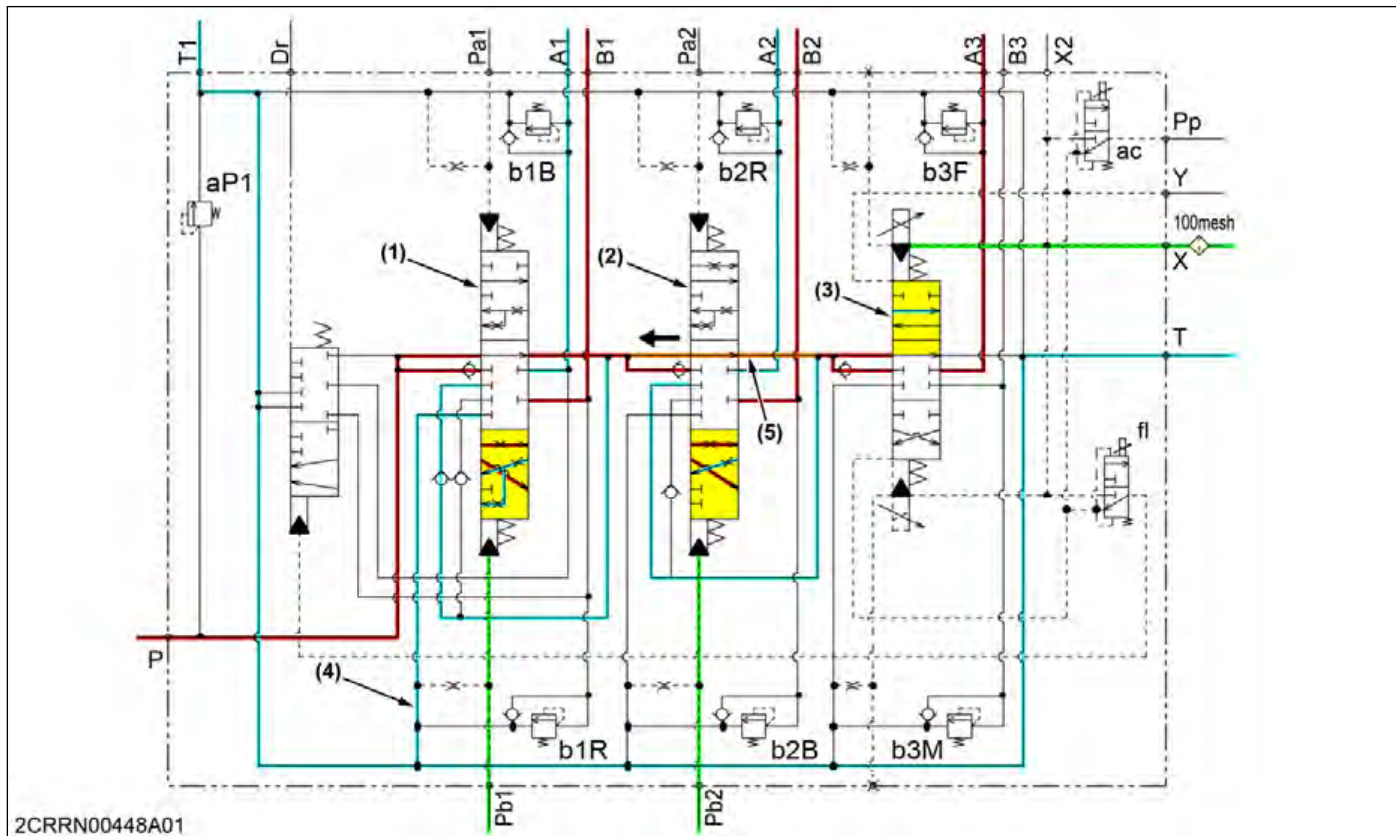
(3) AUX section (overloaded)

(4) Bleed circuit

- Since the control valve is a series hydraulic circuit, returning oil from an actuator flows to the next section.
- If an actuator in the next section is overloaded, the main hydraulic oil flow is interrupted.
- Even when the oil flow is blocked in the next section, the bleed circuit sends the returning oil from the actuator in the previous section to the tank.
- Therefore, the actuator can be operated under such a situation.

6.4.8 Regeneration circuit

The regeneration circuit regenerates the returning oil from the bucket cylinder to compensate the oil shortage caused by the bleed circuit in the lift arm section.



- | | | |
|----------------------|------------------------------|--------------------------|
| (1) Lift arm section | (3) AUX section (overloaded) | (5) Regeneration circuit |
| (2) Bucket section | (4) Bleed circuit | |

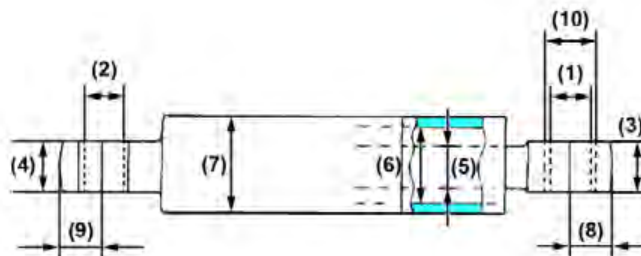
- When the AUX section is overloaded, the bleed circuit in the lift arm section decreases the oil flow to the bucket section.
- To compensate the oil shortage, the regeneration circuit recirculates the returning oil from the bucket cylinders.
- The oil flows back to the inlet port of the bucket section through the PT notch.
- Even when the bleed circuit reduces the oil flow to the bucket cylinders, this regeneration circuit keeps the speed of the bucket cylinders constant.

7. Hydraulic cylinder

7.1 Hydraulic cylinder specifications

NOTE

- All hole dimensions shown below are inner dimensions with bushings installed.

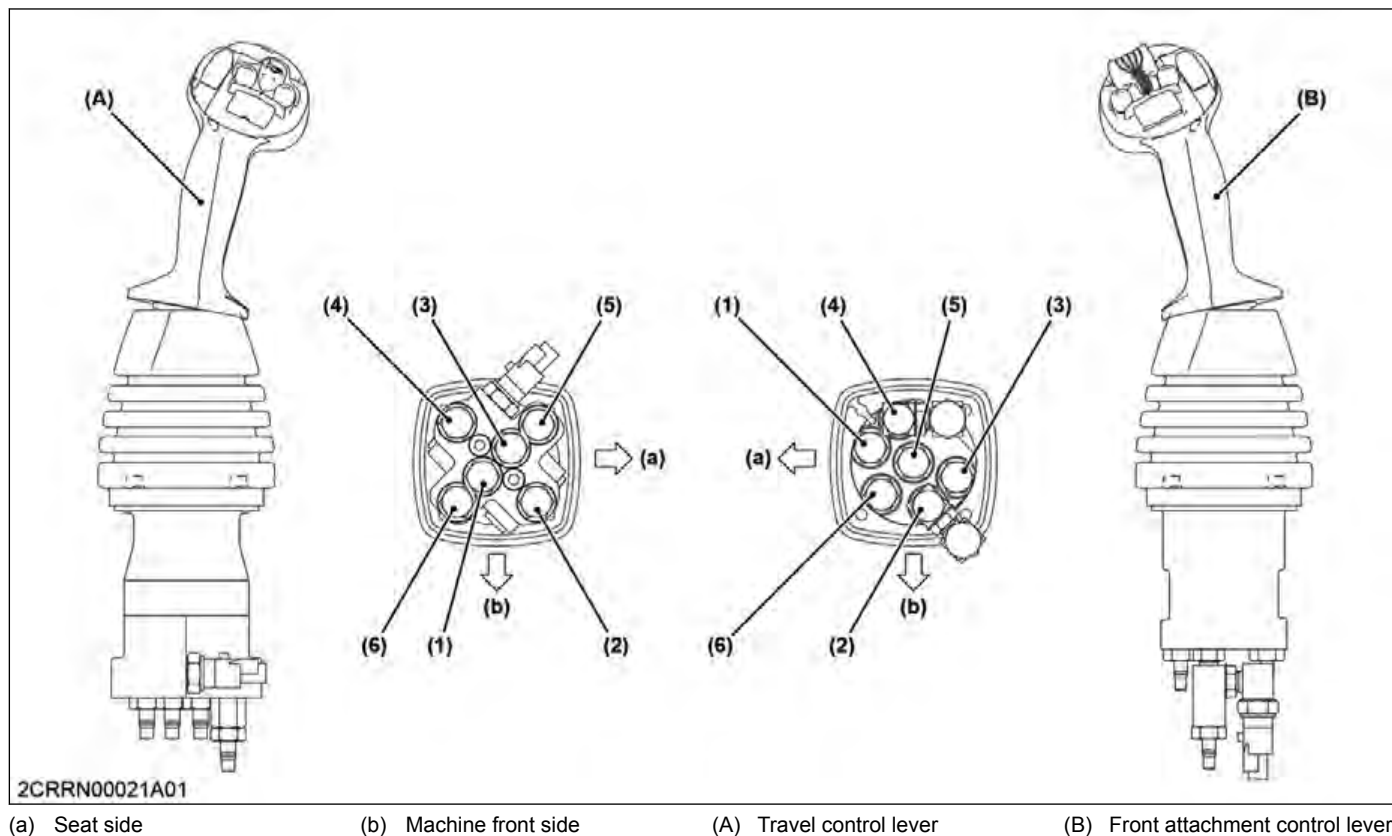


RY9212148HYM022C

	Dimensions		
	Lift arm cylinder	Bucket cylinder	Hydraulic quick hitch cylinder
(1)	φ38.2 mm φ1.50 in.	φ38.2 mm φ1.50 in.	—
(2)	φ38.2 mm φ1.50 in.	φ38.2 mm φ1.50 in.	—
(3)	50 mm 2.0 in.	50 mm 2.0 in.	12 mm 0.47 in.
(4)	50 mm 2.0 in.	50 mm 2.0 in.	12 mm 0.47 in.
(5)	φ40 mm φ1.6 in.	φ35 mm φ1.4 in.	φ30 mm φ1.2 in.
(6)	φ65 mm φ2.6 in.	φ65 mm φ2.6 in.	φ60 mm φ2.4 in.
(7)	φ75 mm φ3.0 in.	φ77 mm φ3.0 in.	φ70 mm φ2.8 in.
(8)	42.5 mm 1.67 in.	42.5 mm 1.67 in.	17 mm 0.67 in.
(9)	40 mm 1.6 in.	40 mm 1.6 in.	17 mm 0.67 in.
(10)	φ47.63 mm φ1.88 in.	φ47.63 mm φ1.88 in.	φ19 mm φ0.75 in.
Minimum length	1025 mm 40.35 in.	601 mm 23.7 in.	618 mm 24.3 in.
Stroke	665 mm 26.2 in.	340 mm 13.4 in.	232 mm 9.13 in.
Manufacturer	Ognibene power spa	Ognibene power spa	Ognibene power spa

8. Pilot control valve

8.1 Pilot control valve specifications



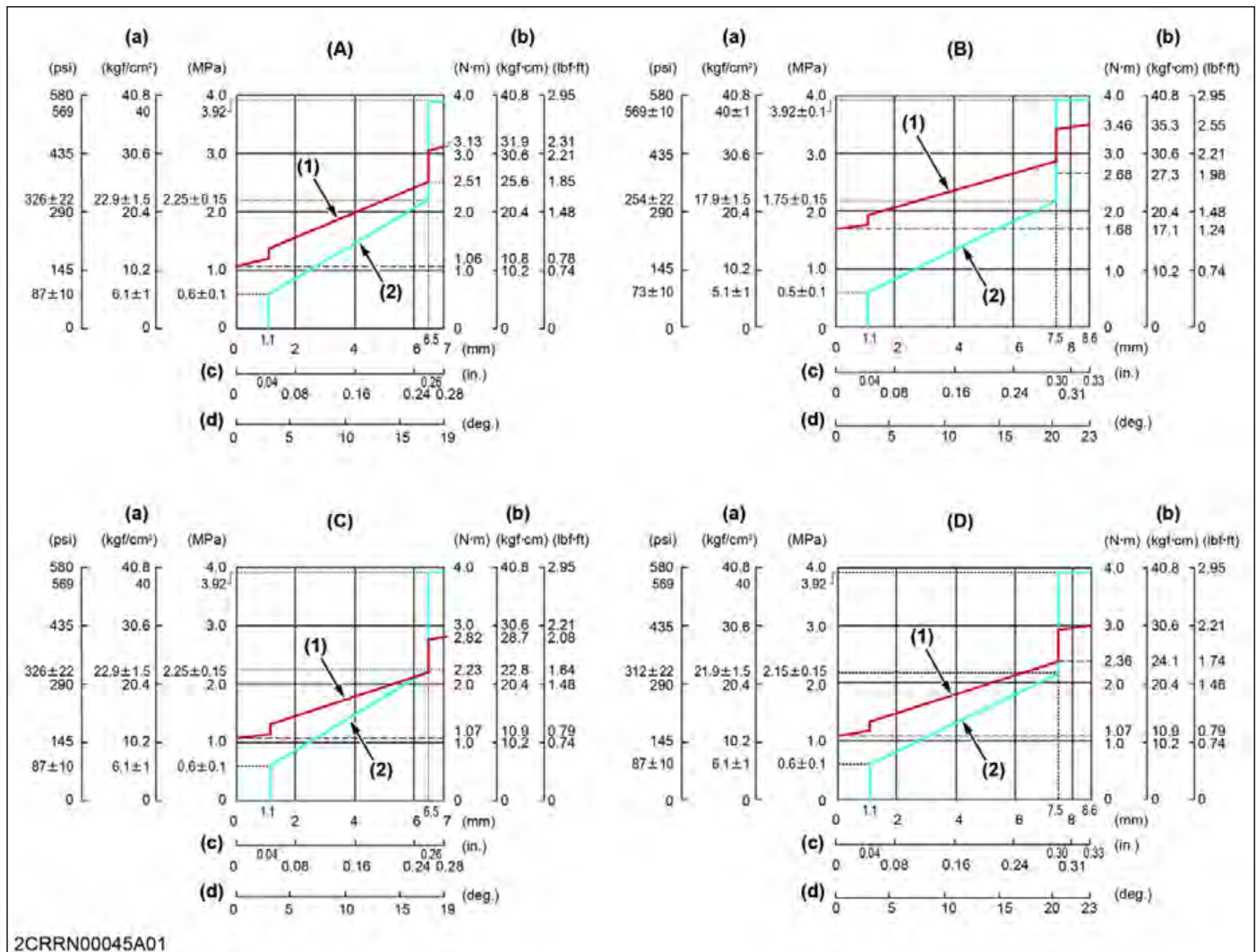
		Specifications
Manufacturer		Kawasaki Heavy Industries, LTD.
Model	Travel control valve	PV48MC1165
	Front attachment control valve	PV48M2364

Port location table

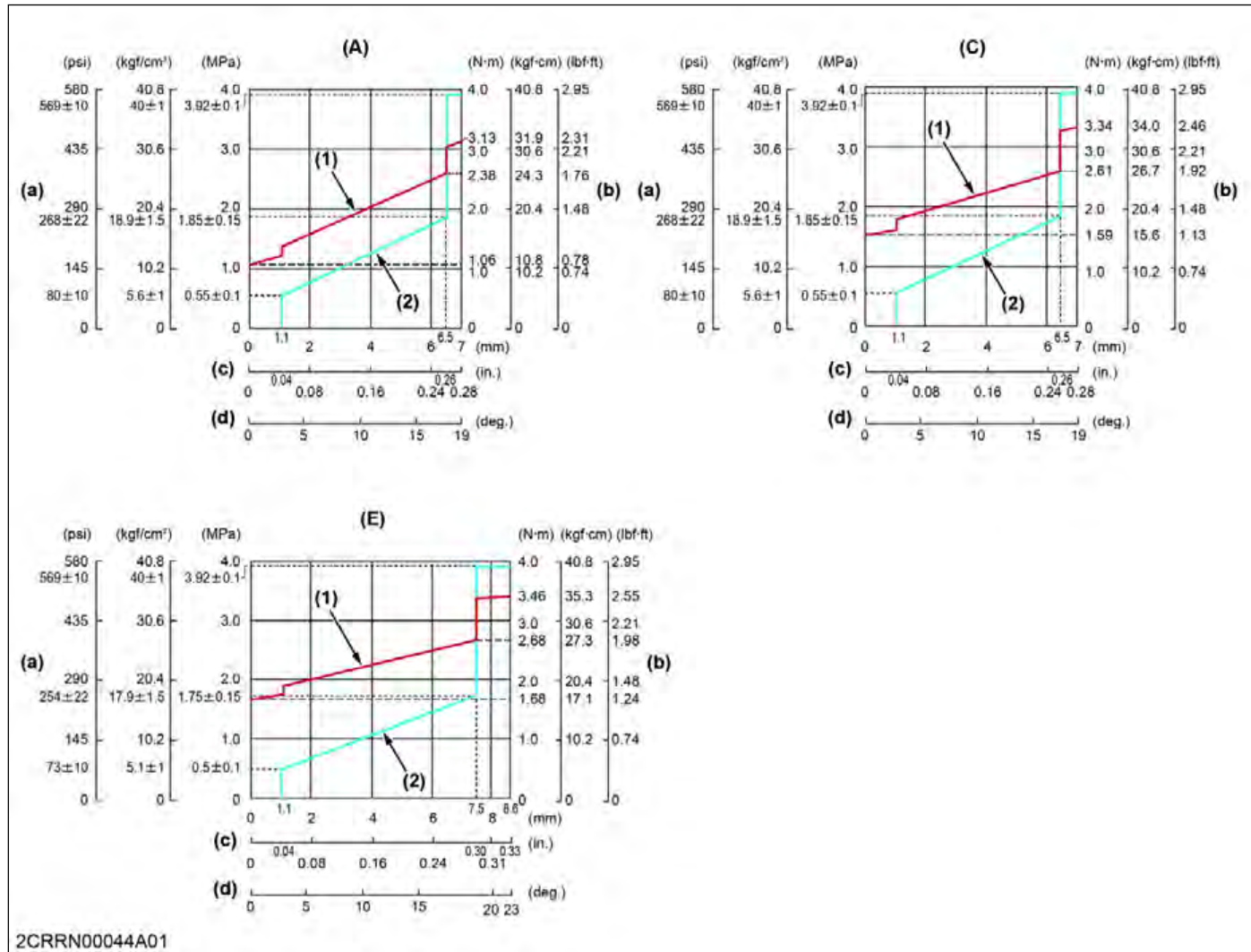
No.	Port	Location	
		Travel control valve	Front attachment control valve
(1)	Port 1	HST pump (port M14) HST motor RH forward movement	Control valve (port Pa2) Bucket crowding
(2)	Port 2	HST pump (port M5) HST motor LH forward movement	Control valve (port Pb1) Lift arm lowering
(3)	Port 3	HST pump (port M15) HST motor RH backward movement	Control valve (port Pb2) Bucket dumping
(4)	Port 4	HST pump (port M4) HST motor LH backward movement	Control valve (port Pa1) Lift arm raising
(5)	Port P	Control valve (port Pp)	Unload valve (port A3)
(6)	Port T	Hydraulic oil tank	Hydraulic oil tank

8.2 Pilot control valve performance diagram

Front attachment control valve



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Travel control valve

2CRRN00044A01

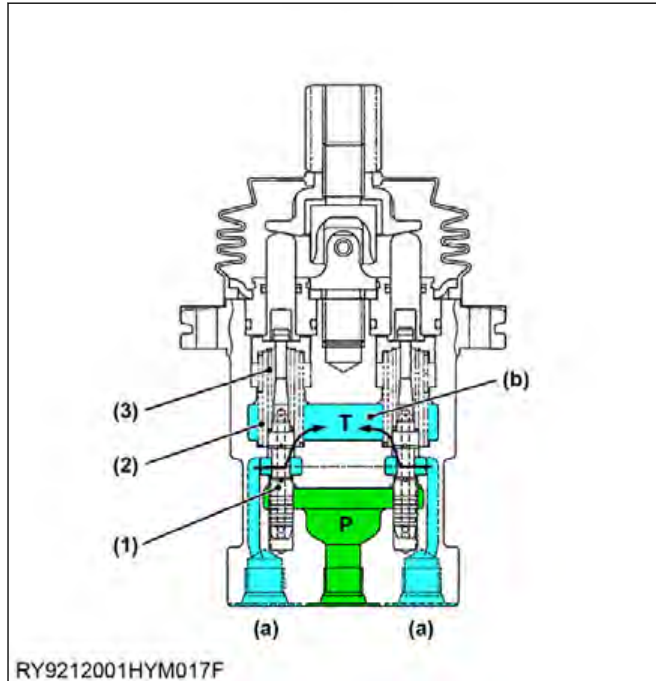
- (1) Single operating torque (b) Operating torque (A) Port 1
 (2) Secondary operating pressure (c) Push rod stroke (C) Port 3
 (a) Secondary pressure (d) Operating angle (E) Port 2, 4

8.3 Pilot control valve function and structure

Controls the direction and the amount of the pilot pressure, and reduces the pilot primary pressure.

Front attachment control valve

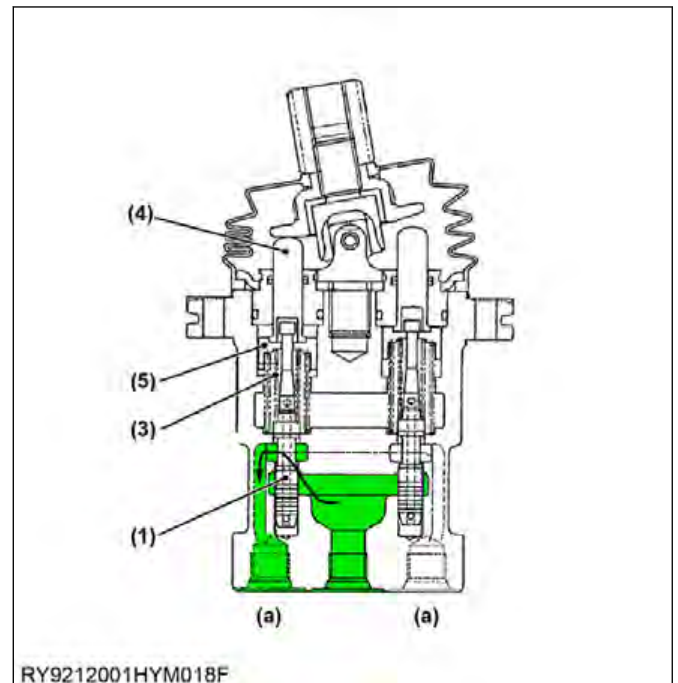
When not being operated



- | | |
|--|----------------------------|
| (1) Spool | (a) Output port |
| (2) Return spring | (b) Hydraulic tank circuit |
| (3) Return spring for setting secondary pressure | |

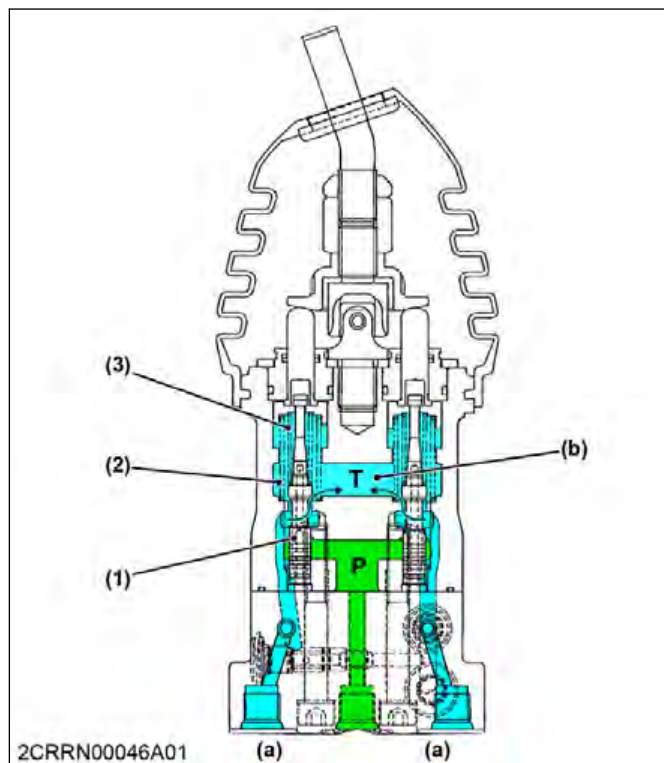
- The hydraulic oil from the charge pump flows into port P.
- The output ports are connected to port T.

When being operated



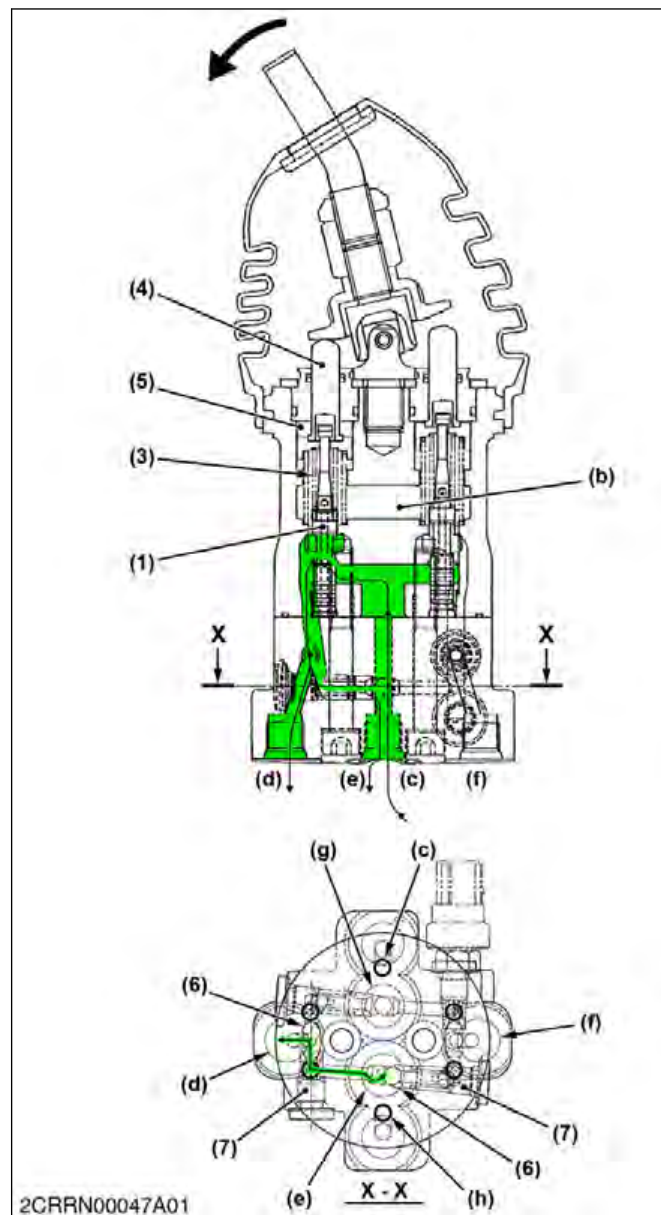
- | | |
|--|-----------------|
| (1) Spool | (4) Push rod |
| (3) Return spring for setting secondary pressure | (5) Spring seat |
| | (a) Output port |

- The spool is pushed by the push rod according to the angle of the travel control lever.
- The primary pressure from the charge pump is reduced according to the spool stroke.
- The secondary pressure oil flows to the control valve.

Travel control valveWhen not being operated

- | | |
|--|----------------------------|
| (1) Spool | (a) Output port |
| (2) Return spring | (b) Hydraulic tank circuit |
| (3) Return spring for setting secondary pressure | |

- The hydraulic oil from the charge pump flows into port P.
- The output ports are connected to port T.

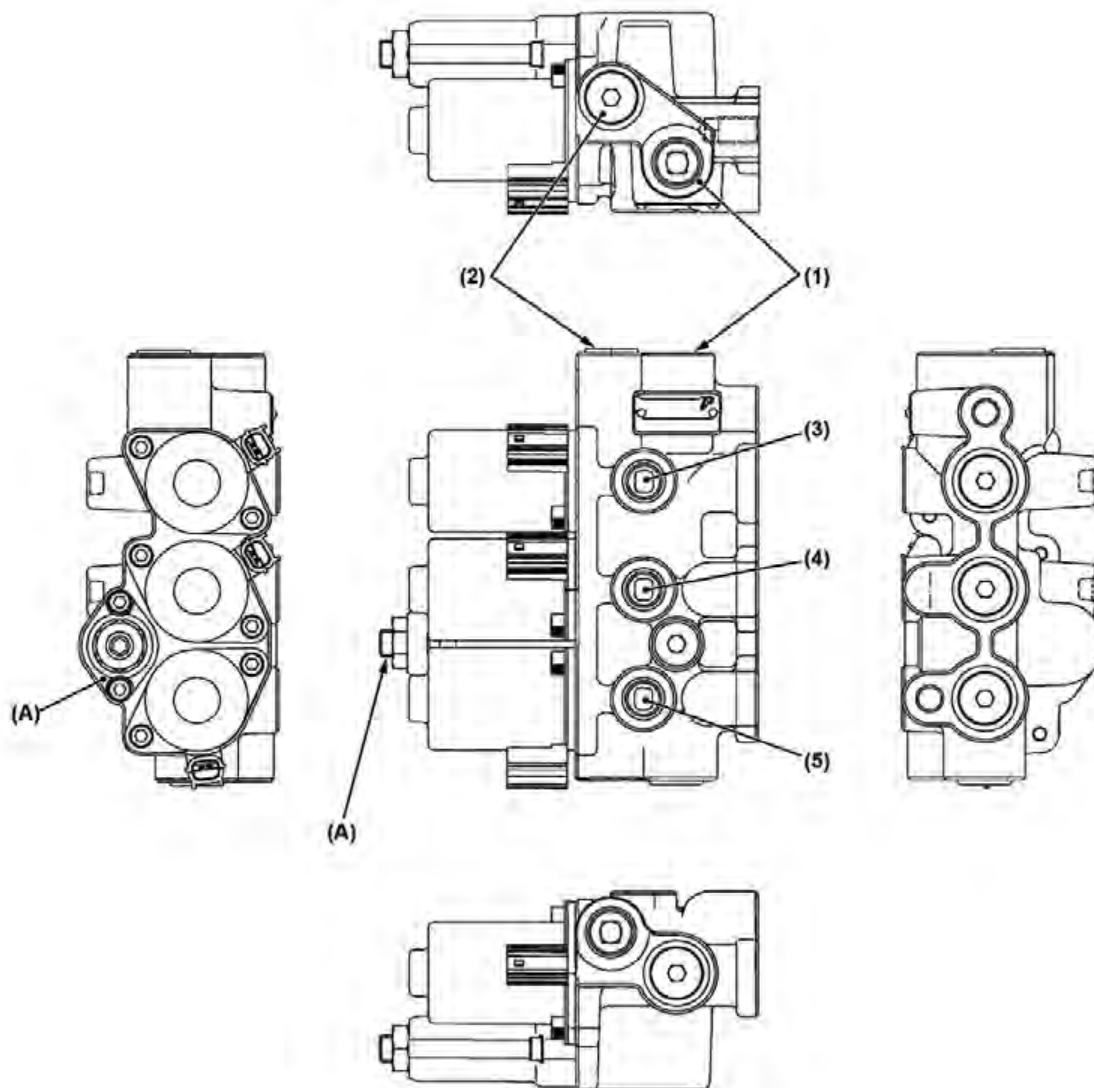
When being operated

- | | |
|--|----------------------------|
| (1) Spool | (b) Hydraulic tank circuit |
| (3) Return spring for setting secondary pressure | (c) Port P |
| (4) Push rod | (d) Port 2 |
| (5) Spring seat | (e) Port 1 |
| (6) Steel ball | (f) Port 4 |
| (7) Shuttle valve | (g) Port 3 |
| | (h) Port T |

- The spool is pushed by the push rod according to the angle of the travel control lever.
- The primary pressure from the charge pump is reduced according to the spool stroke.
- The secondary pressure oil presses the steel ball of the shuttle valve, and is divided into 2 passages.
- Both of the secondary pressure oils flow to the servo cylinder of the HST pump.

9. Unload valve

9.1 Unload valve specifications



2CRRN00022A01

(A) Unload relief valve (pUR)

	Specifications	Remarks
Manufacturer	Nishina Industrial Co.,LTD.	—
Model	17043-00000	—
Maximum pressure	4.9 MPa	—
Relief set pressure	3.5 MPa 36 kgf/cm ² 510 psi	At 3.4 L/min At 0.90 U.S.gals/min

Port location table

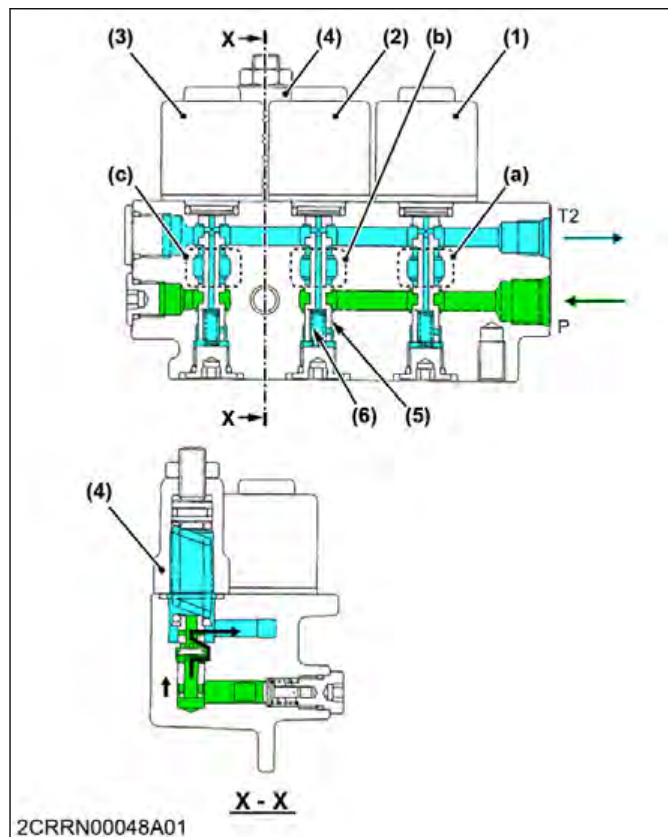
No.	Port	Location
(1)	Port P	Control valve (port X2) Supply of the hydraulic oil from the charge pump
(2)	Port T2	Hydraulic oil tank
(3)	Port A1	HST motor LH (port Pb) HST motor RH (port Pb) Parking brake
(4)	Port A2	HST motor LH (port P2) HST motor RH (port P2) Travel speed shift
(5)	Port A3	Front attachment control valve (port P) Front attachment operation

9.2 Unload valve function and structure

9.2.1 Unload valve working principles

Controls the hydraulic oil passages to parking brake, travel speed shift, and front attachment operation.

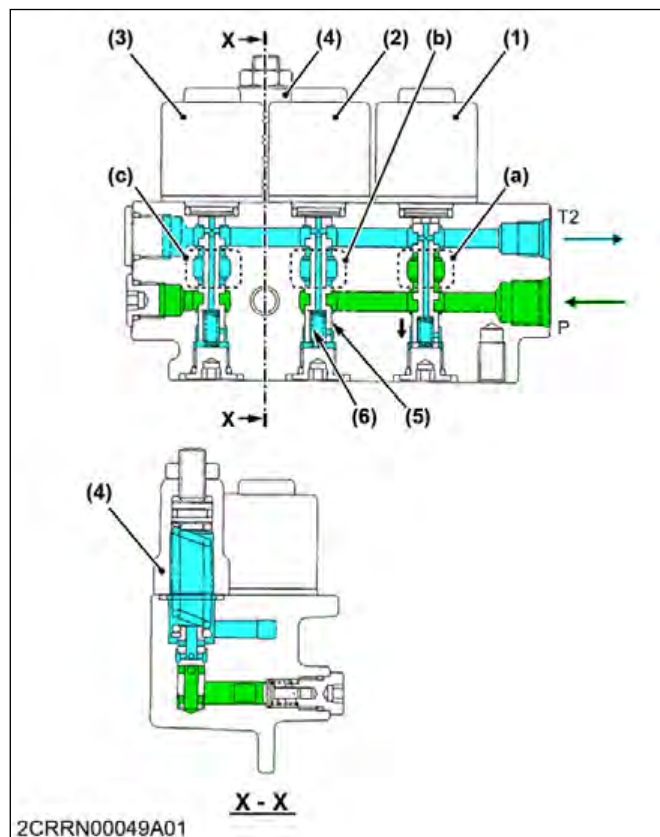
Solenoid OFF



- | | |
|-------------------------|-------------|
| (1) Solenoid 1 | (6) Spring |
| (2) Solenoid 2 | (a) Port A1 |
| (3) Solenoid 3 | (b) Port A2 |
| (4) Unload relief valve | (c) Port A3 |
| (5) Spool | |

- The outlet ports (A1, A2, A3) are connected to the hydraulic oil tank.
- The hydraulic oil from the charge pump opens the relief valve, and returns to the hydraulic oil tank.

Solenoid ON

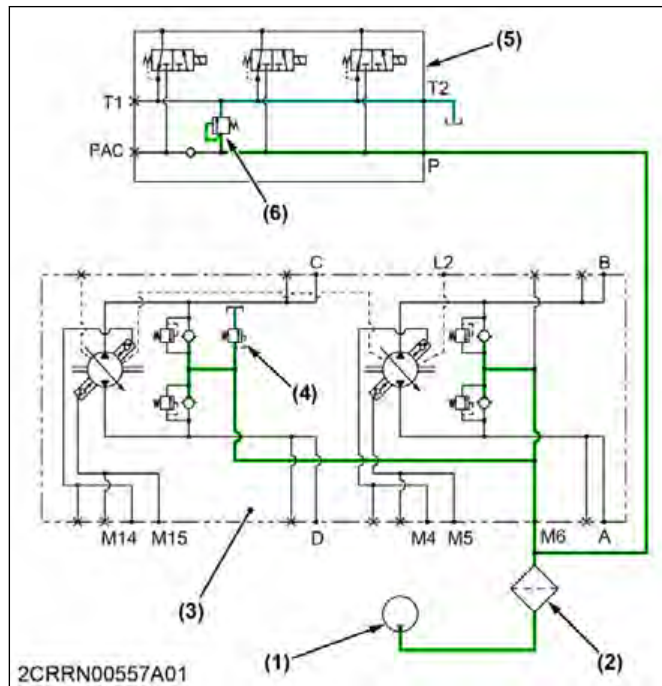


- | | |
|-------------------------|-------------|
| (1) Solenoid 1 | (6) Spring |
| (2) Solenoid 2 | (a) Port A1 |
| (3) Solenoid 3 | (b) Port A2 |
| (4) Unload relief valve | (c) Port A3 |
| (5) Spool | |

- When the voltage is applied to any solenoid, its spool is pressed downward.
- The outlet port gets connected to port P.
- The hydraulic oil from the charge pump flows to the each location.

9.2.2 Warmup function

Warms up the hydraulic oil temperature in cold condition to preserve the pilot control responsiveness.



- | | |
|---|--|
| (1) Charge pump | (5) Unload valve |
| (2) HST filter | (6) Unload relief valve (3.5 MPa,
36 kgf/cm ² , 510 psi) |
| (3) HST pump | |
| (4) Charge relief valve
(3.0 MPa, 31 kgf/cm ² ,
440 psi) | |

When warming up

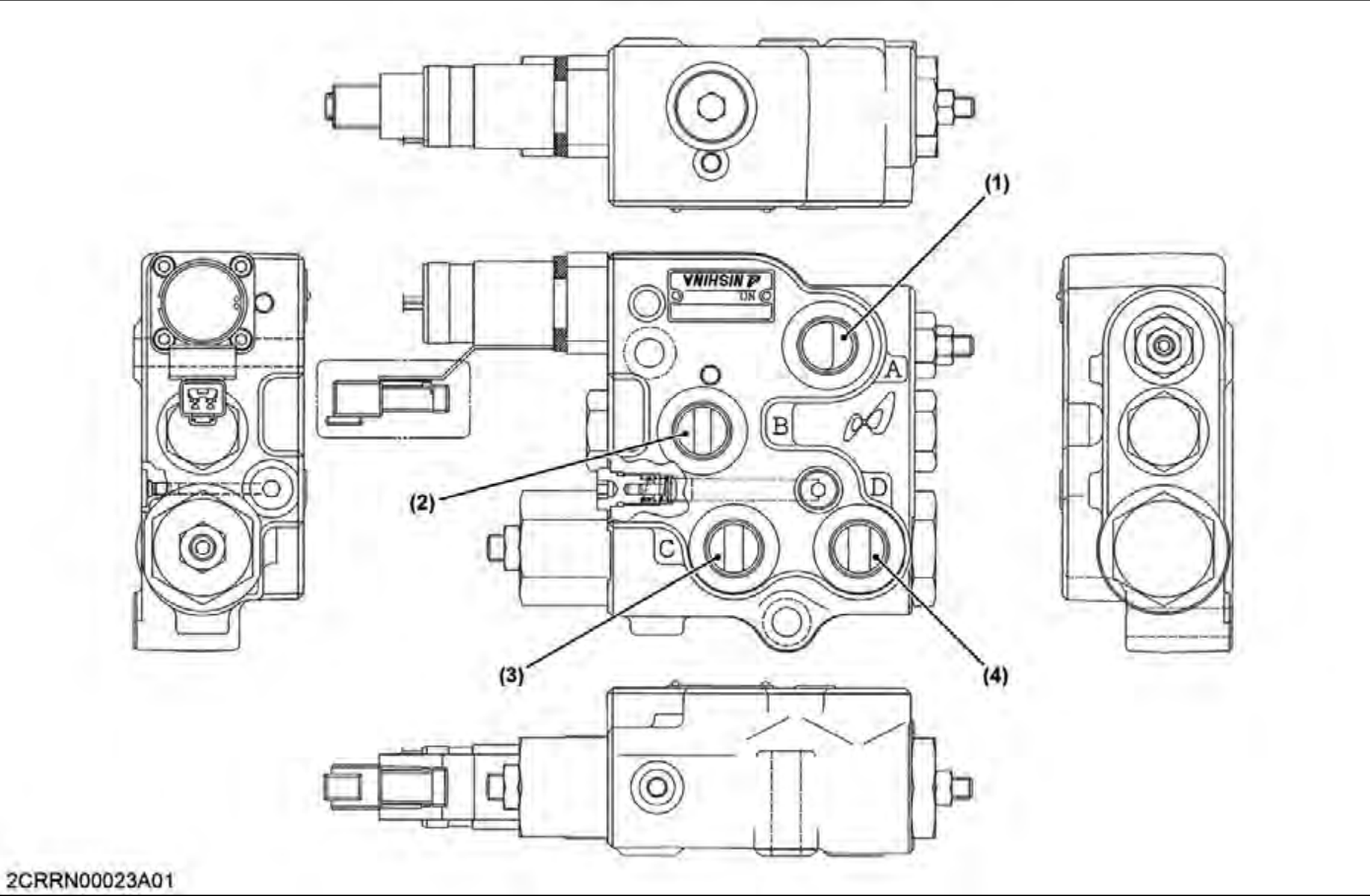
- Since the setting pressure of the charge relief valve is lower than that of the unload relief valve, the charge relief valve relieves the pilot control pressure.
- In cold condition, the primary pressure of the unload valve may be higher than the setting pressure of the unload valve since the viscosity of the hydraulic oil increases.
- The unload relief valve also relieves the pilot control pressure.
- By relieving the pressurized hydraulic oil, the pressure is converted into heat energy to warm up the hydraulic oil.

After warming up

- Since the relief pressure of the charge relief valve is lower than that of the unload relief valve, the charge relief valve relieves the pilot control pressure.
- The primary pressure of the unload valve is controlled by the charge relief valve.

10. Self-leveling solenoid valve

10.1 Self-leveling solenoid valve specifications



	Specifications
Manufacturer	Nishina Industrial Co.,LTD.
Maximum flow rate	50.6 L/min 2.6 U.S.gals/min
Maximum pressure	23 MPa 230 kgf/cm ² 3300 psi

Port location table

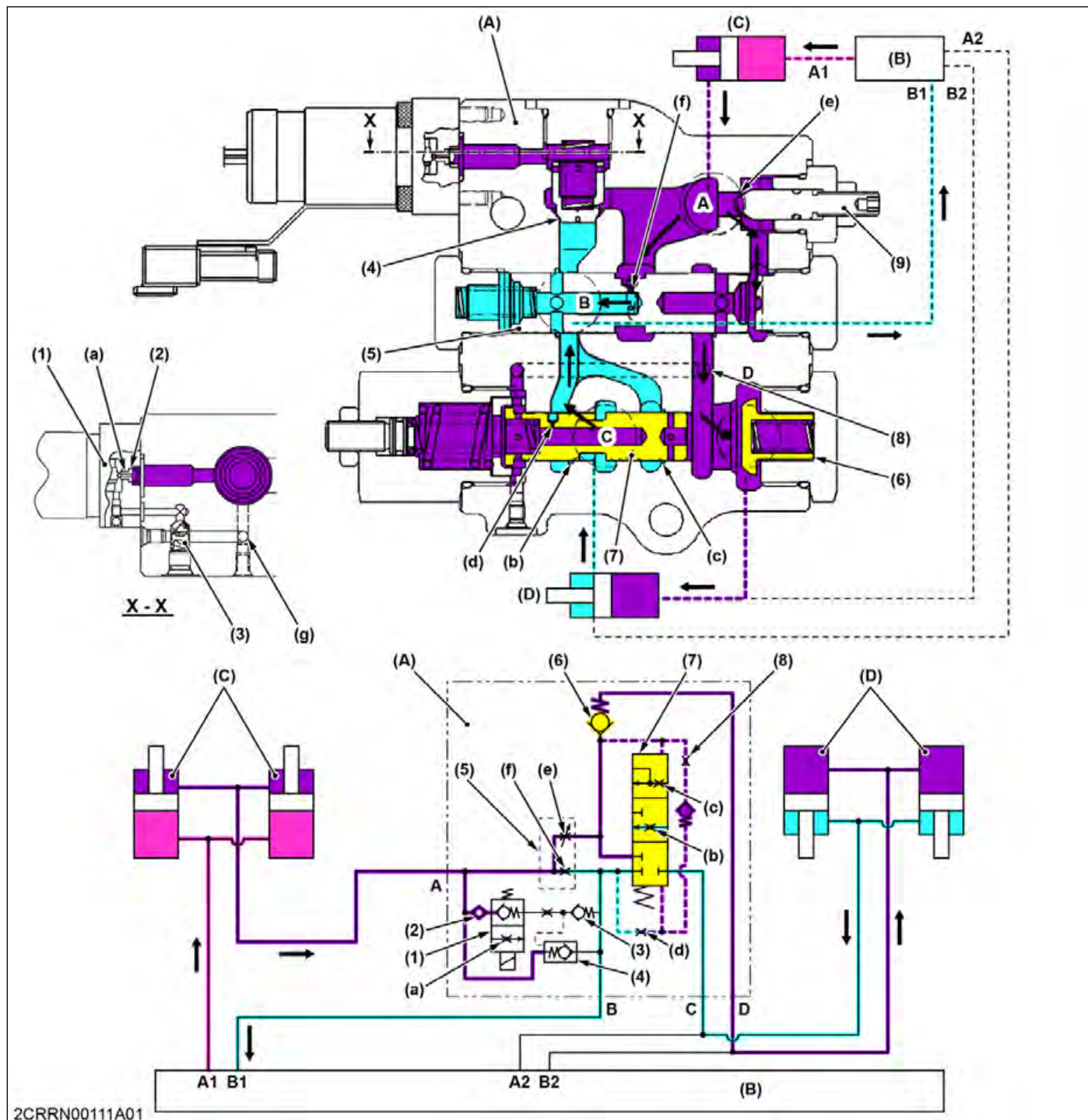
No.	Port	Location
(1)	Port A	Lift arm cylinder rod side
(2)	Port B	Control valve (port B1)
(3)	Port C	Bucket cylinder rod side Control valve (port A2)
(4)	Port D	Bucket cylinder bottom side Control valve (port B2)

10.2 Self-leveling solenoid valve function and structure

10.2.1 Self-leveling solenoid valve working principles

Keeps the bucket angle horizontal while raising the lift arm. Works only when raising the lift arm.

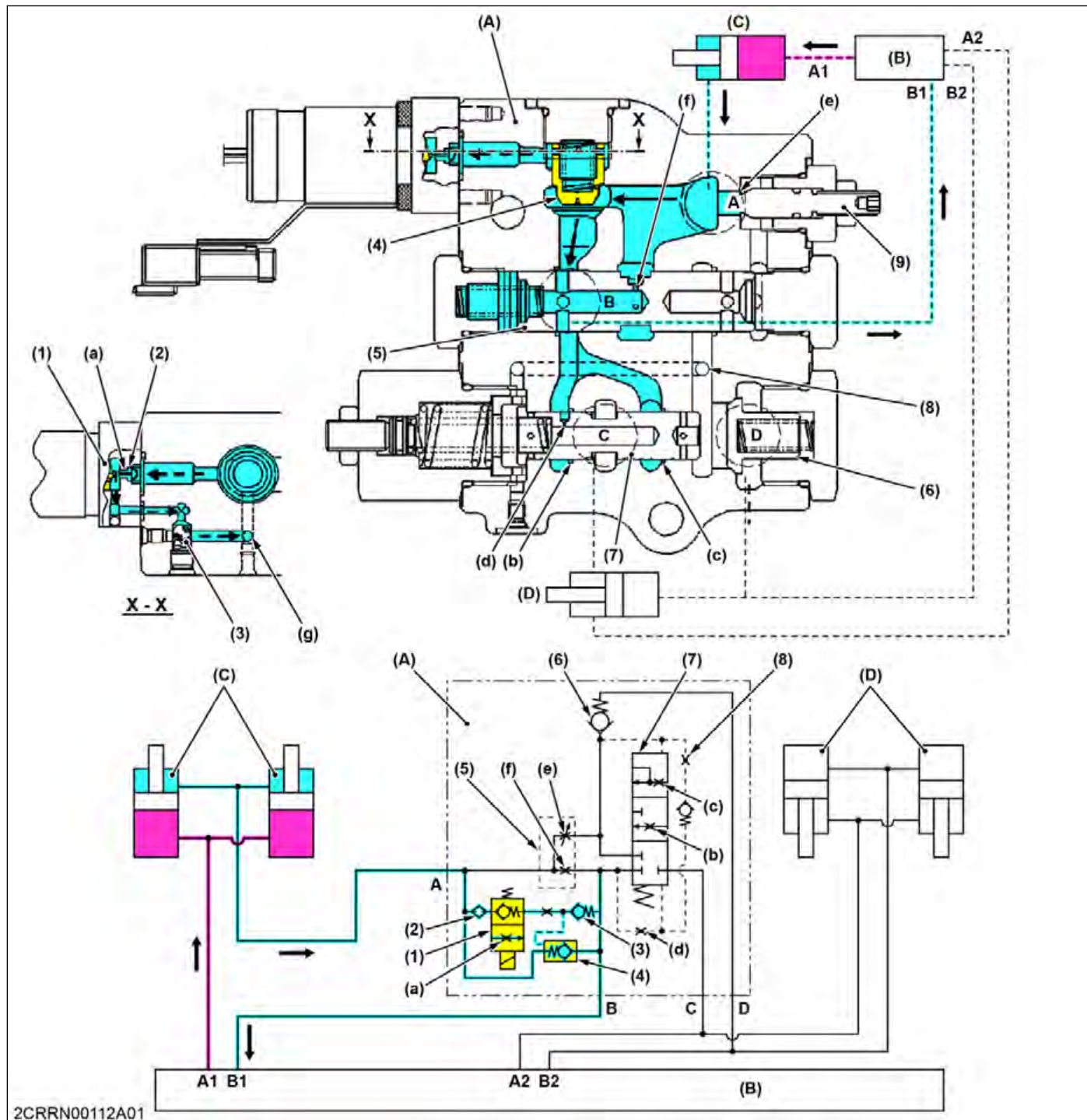
Raising the lift arm (self-leveling switch is ON)



- | | | | |
|---------------------------|----------------------------------|---------------|----------------------------------|
| (1) Solenoid valve | (6) Check valve | (b) Orifice B | (g) To port B |
| (2) Filter | (7) Counterbalance valve spool | (c) Orifice C | (A) Self-leveling solenoid valve |
| (3) Steel ball and spring | (8) Orifice plug | (d) Orifice D | (B) Control valve |
| (4) Logic valve | (9) Flow divide adjustment valve | (e) Orifice E | (C) Lift arm cylinder |
| (5) Flow divider spool | (a) Orifice A | (f) Orifice F | (D) Bucket cylinder |

- When raising the lift arm while the self-leveling switch is ON, voltage is not applied to the solenoid valve.
- The hydraulic oil from the main pump flows from control valve port A1 to the bottom side of the lift arm cylinders.

- The hydraulic oil in the rod side of the lift arm cylinders is pressed into the self-leveling solenoid valve port A.
- The hydraulic oil is divided into 4 passages inside of the self-leveling solenoid valve.
 - The hydraulic oil passes through the hole of the logic valve, and flows toward the solenoid valve.
 - The hydraulic oil stops at the solenoid valve as the solenoid valve is not open.
 - The hydraulic oil passes through the orifice F, and flows toward the port B.
 - The hydraulic oil flows to the control valve port B1, and returns to the hydraulic oil tank.
 - The hydraulic oil passes through the orifice E and the check valve, and flows toward the bottom side of the bucket cylinder through the port D.
 - The bucket performs dumping gradually according to the lift arm raising.
 - The hydraulic oil passes through the orifice E, and flows into the right side of the counterbalance valve spool.
 - The hydraulic oil passes through the orifice plug, and also flows into the left side of the counterbalance valve spool.
 - The oil pressure in the right side of the counterbalance valve spool is higher than that in the left side, as the pressure in the right side is in the high pressure circuit and that in the left side is in low pressure circuit.
 - The counterbalance valve spool is pressed left by the pressure difference between the right side and left side of the counterbalance valve spool.
 - The oil passage of the counterbalance valve spool is changed. The hydraulic oil flows from the port C to the port B through the orifice B.
 - When the bucket cylinder reaches its stroke end, the oil pressure in the right side of the counterbalance valve spool becomes higher and the counterbalance valve spool is pressed to the left side end. The hydraulic oil flows to the port B through the orifice C.

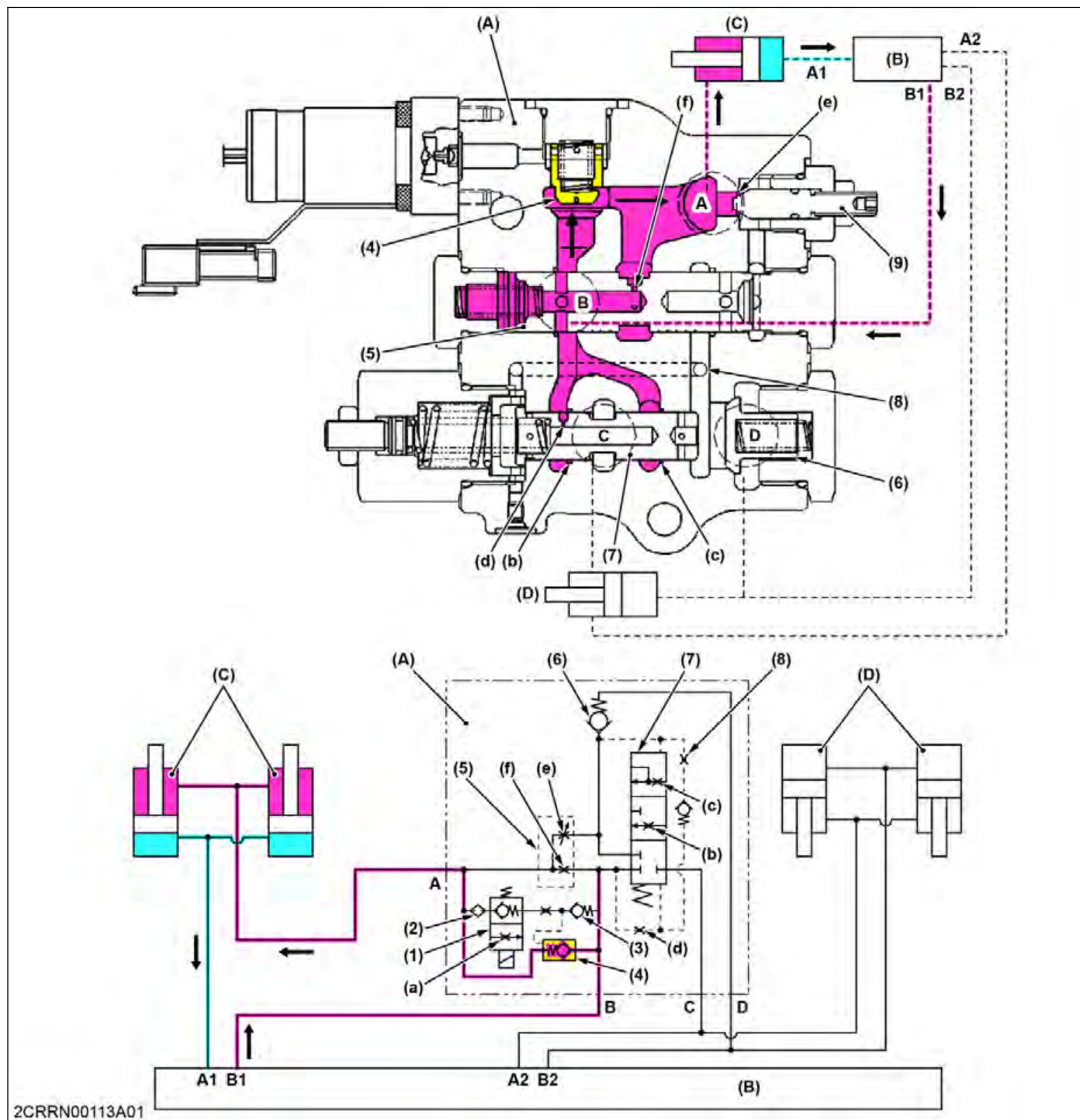
Raising the lift arm (self-leveling switch is OFF)

2CRRN00112A01

- | | | | |
|---------------------------|----------------------------------|---------------|----------------------------------|
| (1) Solenoid valve | (6) Check valve | (b) Orifice B | (g) To port B |
| (2) Filter | (7) Counterbalance valve spool | (c) Orifice C | (A) Self-leveling solenoid valve |
| (3) Steel ball and spring | (8) Orifice plug | (d) Orifice D | (B) Control valve |
| (4) Logic valve | (9) Flow divide adjustment valve | (e) Orifice E | (C) Lift arm cylinder |
| (5) Flow divider spool | (a) Orifice A | (f) Orifice F | (D) Bucket cylinder |

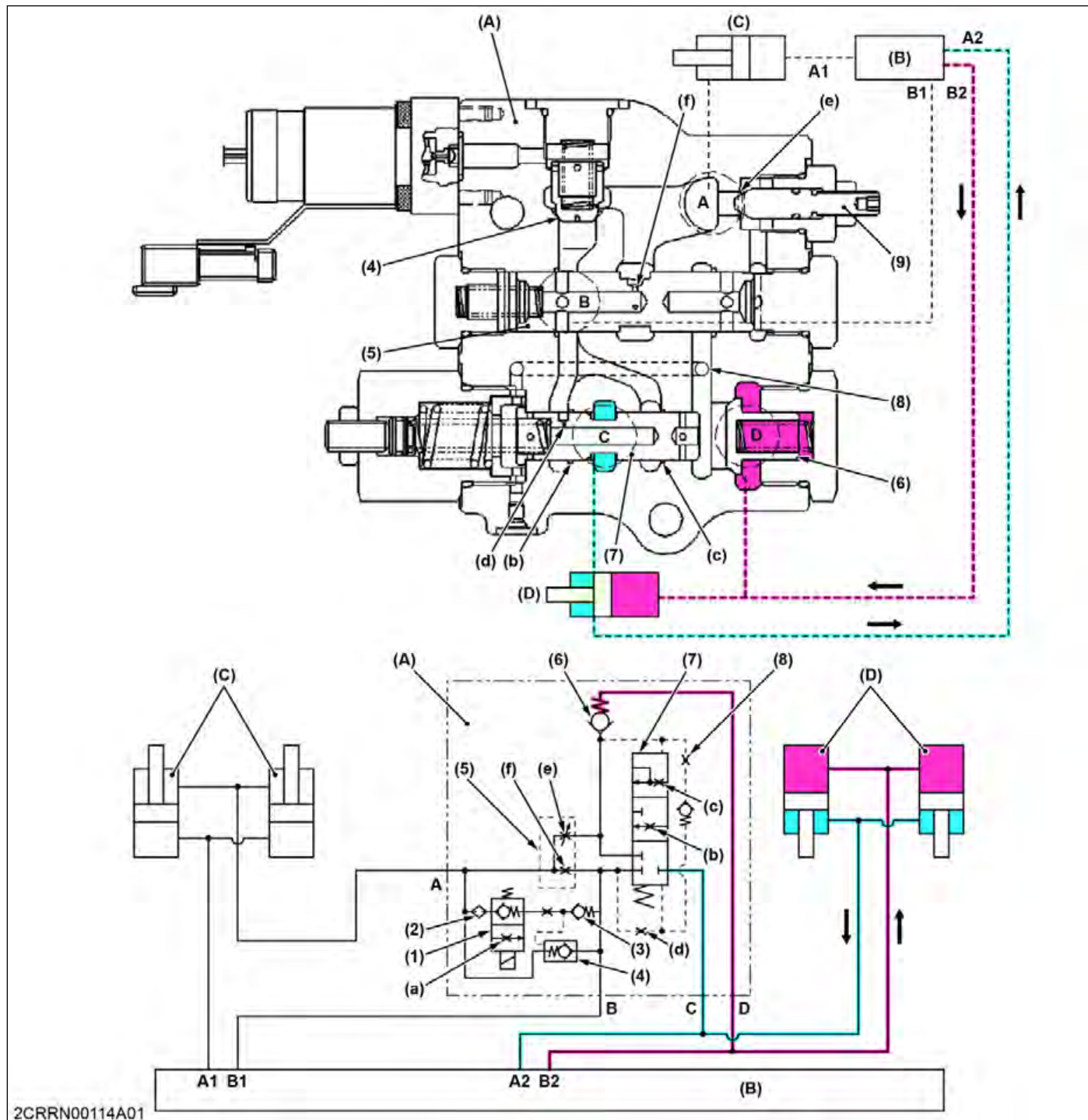
- When raising the lift arm while the self-leveling switch is OFF, voltage is applied to the solenoid valve.
- The solenoid valve opens, and the oil pressure in the logic valve decreases.
- The differential pressure between in front of and behind the logic valve opens the logic valve.
- The open area of the logic valve is larger than the orifice E and F.
- The hydraulic oil flows from the port A to the port B without dividing.
- The hydraulic oil does not flow into the bucket cylinders, and thus the self-leveling function becomes disabled.

Lowering the lift arm



- | | | | |
|---------------------------|----------------------------------|---------------|----------------------------------|
| (1) Solenoid valve | (6) Check valve | (b) Orifice B | (A) Self-leveling solenoid valve |
| (2) Filter | (7) Counterbalance valve spool | (c) Orifice C | (B) Control valve |
| (3) Steel ball and spring | (8) Orifice plug | (d) Orifice D | (C) Lift arm cylinder |
| (4) Logic valve | (9) Flow divide adjustment valve | (e) Orifice E | (D) Bucket cylinder |
| (5) Flow divider spool | (a) Orifice A | (f) Orifice F | |

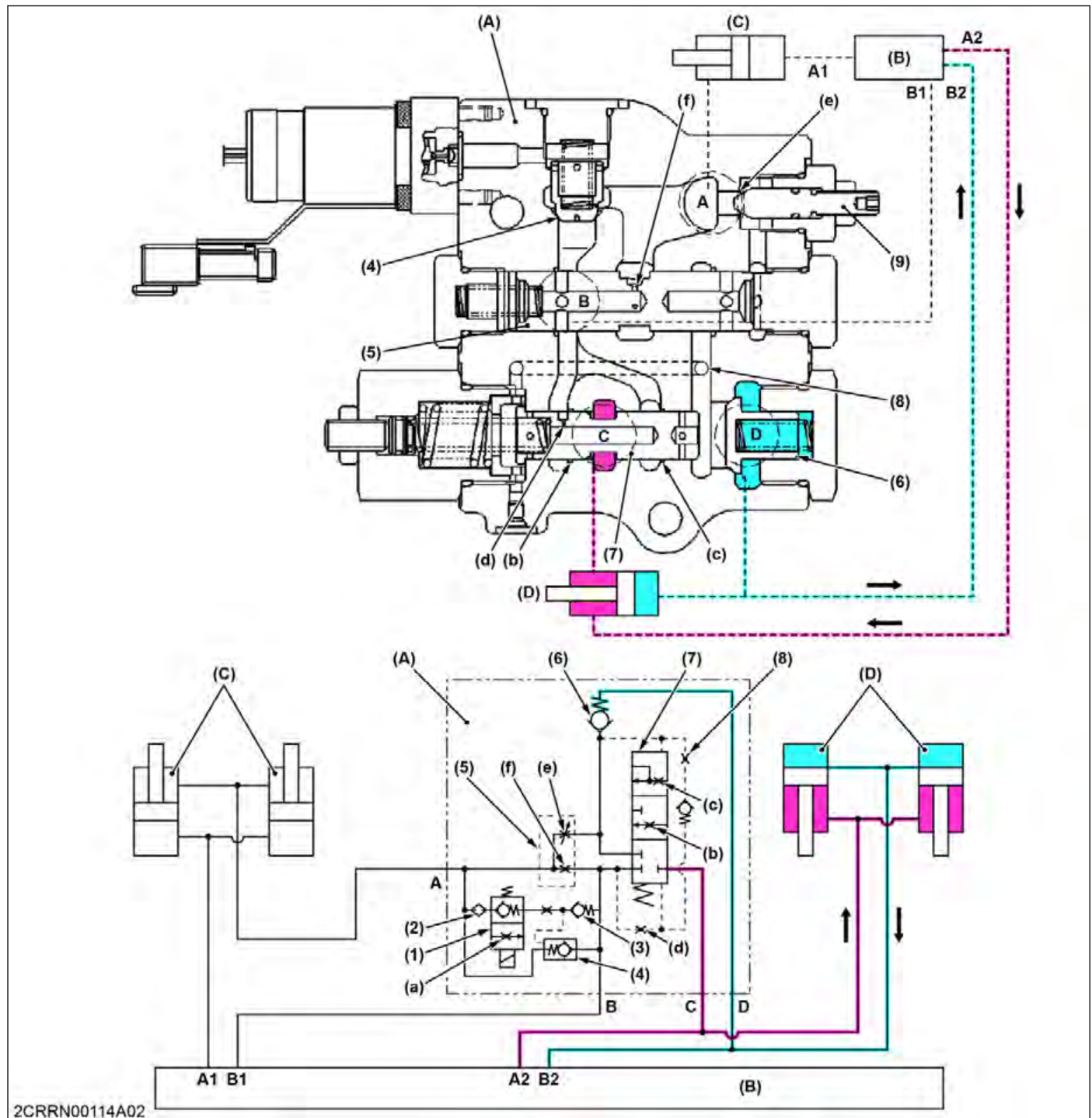
- The hydraulic oil from the main pump flows to the self-leveling solenoid valve port B.
- The pressurized oil opens the logic valve, and flows from port A to the rod side of the lift arm cylinder.
- The lift arm is lowered, and the hydraulic oil flows back to the control valve port A1.
- The hydraulic oil does not flow into the bucket cylinders, and thus the self-leveling function becomes disabled.

Dumping the bucket

- | | | | |
|---------------------------|----------------------------------|---------------|----------------------------------|
| (1) Solenoid valve | (6) Check valve | (b) Orifice B | (A) Self-leveling solenoid valve |
| (2) Filter | (7) Counterbalance valve spool | (c) Orifice C | (B) Control valve |
| (3) Steel ball and spring | (8) Orifice plug | (d) Orifice D | (C) Lift arm cylinder |
| (4) Logic valve | (9) Flow divide adjustment valve | (e) Orifice E | (D) Bucket cylinder |
| (5) Flow divider spool | (a) Orifice A | (f) Orifice F | |

- The hydraulic oil from the control valve port B2 flows into the bottom side of the bucket cylinder.
- The hydraulic oil in the rod side of the bucket cylinder flows to the control valve port A2.
- The hydraulic oil reaches the self-leveling solenoid valve port C and port D.
- The counterbalance valve spool and the check valve prevent the hydraulic oil from flowing into the self-leveling solenoid valve.

Crowding the bucket

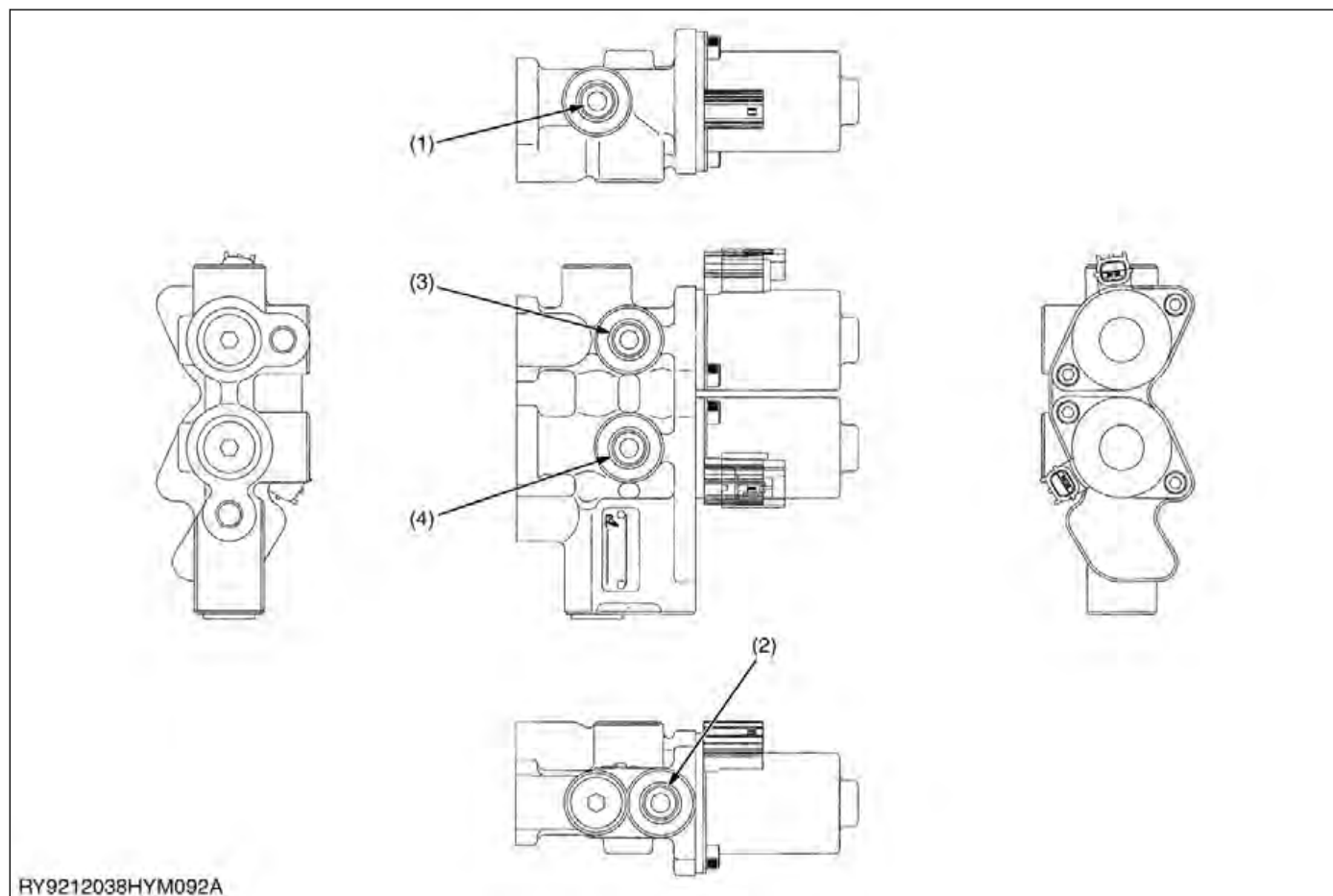


- | | | | |
|---------------------------|----------------------------------|---------------|----------------------------------|
| (1) Solenoid valve | (6) Check valve | (b) Orifice B | (A) Self-leveling solenoid valve |
| (2) Filter | (7) Counterbalance valve spool | (c) Orifice C | (B) Control valve |
| (3) Steel ball and spring | (8) Orifice plug | (d) Orifice D | (C) Lift arm cylinder |
| (4) Logic valve | (9) Flow divide adjustment valve | (e) Orifice E | (D) Bucket cylinder |
| (5) Flow divider spool | (a) Orifice A | (f) Orifice F | |

- The hydraulic oil from the control valve port A2 flows into the rod side of the bucket cylinder.
- The hydraulic oil in the bottom side of the bucket cylinder flows to the control valve port B2.
- The hydraulic oil reaches the self-leveling solenoid valve port C and port D.
- The counterbalance valve spool and the check valve prevent the hydraulic oil from flowing into the self-leveling solenoid valve.

11. Hydraulic quick hitch solenoid valve

11.1 Hydraulic quick hitch solenoid valve specifications

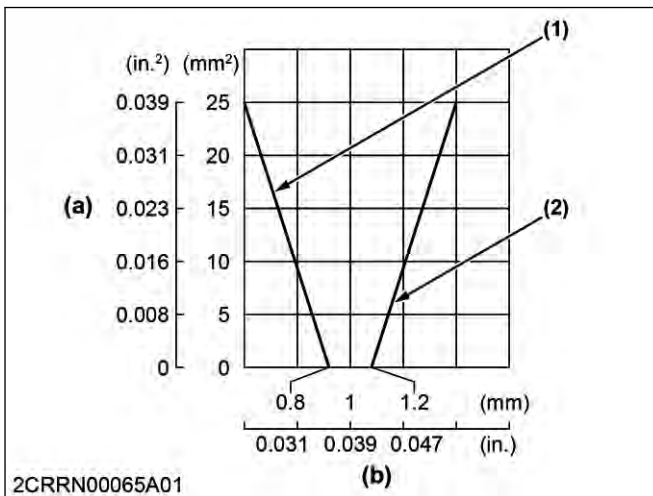


	Specifications	Remarks
Manufacturer	Nishina Industrial Co.,LTD.	—
Maximum pressure	At 4.9 MPa At 50 kgf/cm ² At 710 psi	
Leak amount (Port P to port T)	Less than 220 cm ³ /min Less than 13.4 in. ³ /min	At 4.9 MPa At 50 kgf/cm ² At 710 psi

Port location table

No.	Port	Location
(1)	Port P	Charge pump
(2)	Port T	Hydraulic oil tank
(3)	Port A	Hydraulic quick hitch cylinder bottom side
(4)	Port B	Hydraulic quick hitch cylinder rod side

11.2 Hydraulic quick hitch solenoid valve performance diagram



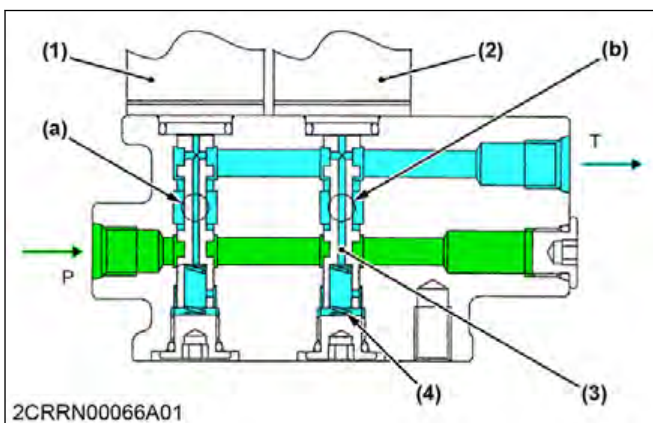
- (1) Port A (B) to port T
(2) Port P to port A (B)
(a) Opening area
(b) Spool stroke

11.3 Hydraulic quick hitch solenoid valve function and structure

11.3.1 Hydraulic quick hitch solenoid valve working principles

Controls the hydraulic oil passages to the hydraulic quick hitch cylinder.

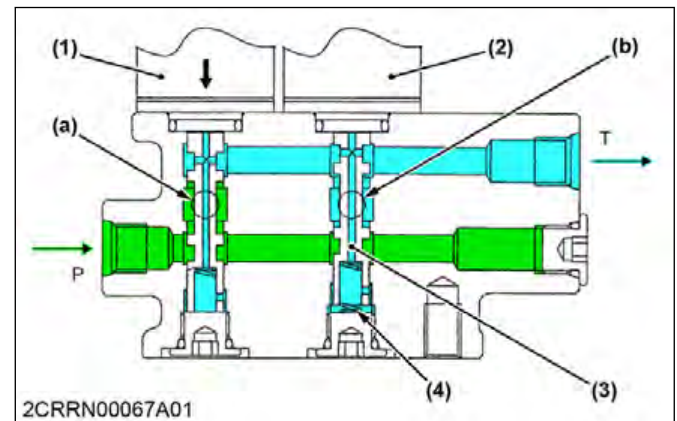
Solenoid OFF



- (1) Solenoid A
(2) Solenoid B
(3) Spool
(4) Spring
(a) Port A
(b) Port B

- The output ports (port A, port B) are connected to port T.
- Hydraulic oil from the charge pump flows into port P.
- Port P and T are not connected.

Solenoid ON

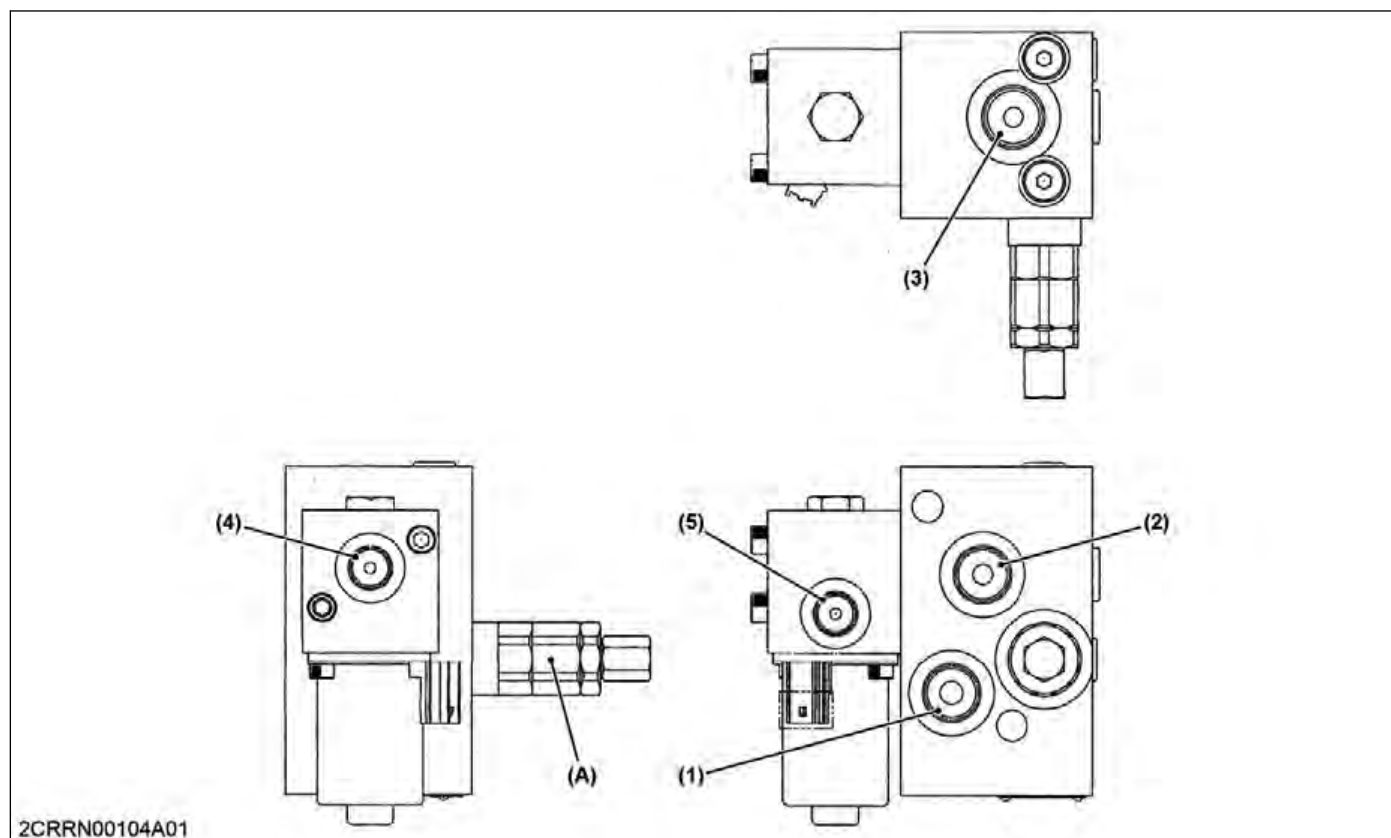


- (1) Solenoid A
(2) Solenoid B
(3) Spool
(4) Spring
(a) Port A
(b) Port B

- When voltage is applied to either solenoid, its spool is pressed downward.
- The output port (either port A or port B) gets connected to port P.
- The hydraulic oil from the charge pump flows to the hydraulic quick hitch cylinder.

12. High-flow solenoid valve

12.1 High-flow solenoid valve specifications



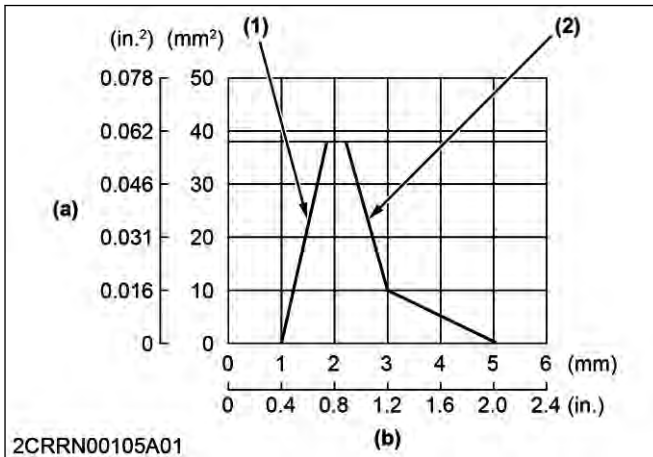
(A) High-flow relief valve

	Specifications	Remarks
Manufacturer	Nishina Industrial Co.,LTD.	—
Maximum pressure	24.5 MPa 250 kgf/cm ² 3550 psi	Port P, port A
	3.92 MPa 40.0 kgf/cm ² 569 psi	Port PP
Leak volume (Port P to port T)	Less than 150 cm ³ /min Less than 9.2 in. ³ /min	At 3.43 MPa At 35.0 kgf/cm ² At 497 psi At solenoid ON
Relief setting pressure	18.0 to 18.5 MPa 184 to 189 kgf/cm ² 2610 to 2680 psi	At 2.0 L/min At 122 in. ³ /min

Port location table

No.	Port	Location	No.	Port	Location
(1)	A	Control valve (port B3)	(4)	PP	HST filter
(2)	P	High-flow pump	(5)	Dr	Hydraulic oil tank
(3)	T	Hydraulic oil tank	—	—	—

12.2 High-flow solenoid valve performance diagram



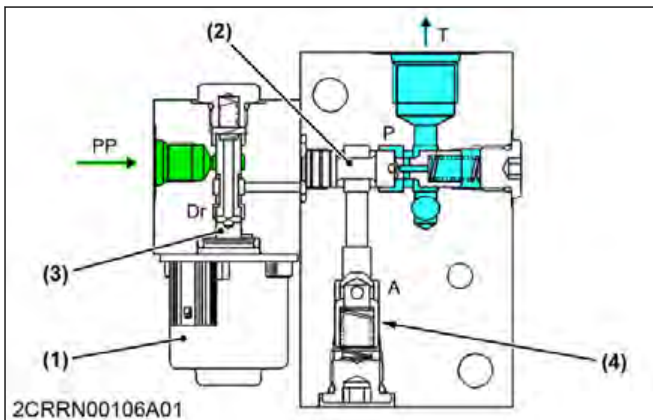
- (1) Port P to port A (a) Opening area
(2) Port P to port T (b) Spool stroke

12.3 High-flow solenoid valve function and structure

12.3.1 High-flow solenoid valve working principles

Increases the AUX flow rate.

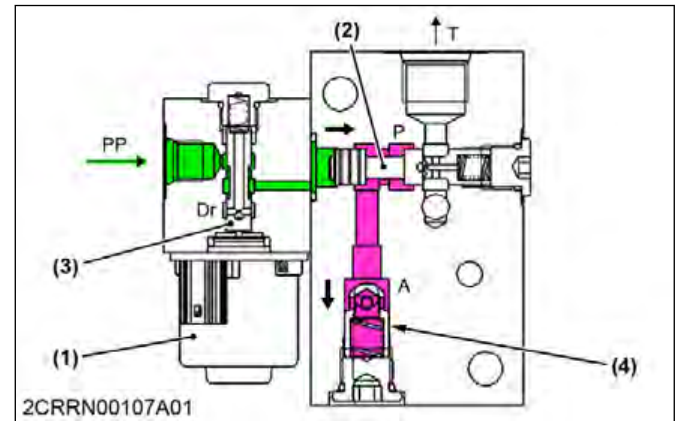
Solenoid OFF



- (1) Solenoid (3) Pilot spool
(2) Main spool (4) Check valve

- The hydraulic oil from the high-flow pump flows into port P, and returns from port T to the hydraulic oil tank.
- The hydraulic oil from the charge pump flows into port PP, and stops at the pilot spool.

Solenoid ON



- (1) Solenoid (3) Pilot spool
(2) Main spool (4) Check valve

- When voltage is applied to the high-flow solenoid, the pilot spool is pressed downward.
- The hydraulic oil, which flows into port PP, presses the main spool to the right.
- Port P connects to port A.
- The hydraulic oil, which flows into port P, presses the check valve and flows from port A to the AUX port.

SERVICING

1. Troubleshooting

1.1 Hydraulic system troubleshooting for the front attachment

The front attachment does not work

Causes	Inspections	Actions
The main pump is malfunctioning.	Measure the flow rate of the main pump.	Repair or replace the main pump.
The main relief valve is clogged by contamination.	Measure the main relief valve pressure.	Clean or replace the main relief valve.
The pilot line filter of the front attachment control valve is clogged by contamination.	Remove the pilot line filter and check for contamination.	Clean or replace the pilot line filter.
The hydraulic unlock solenoid valve of the unload valve is malfunctioning.	Measure the pressure in front of the P port and behind of the A3 port of the unload valve.	Clean or replace the unload valve.
The unload relief valve is clogged by contamination.	Measure the unload relief valve pressure.	Clean or replace the unload relief valve.
The front attachment control valve is malfunctioning.	Measure the pilot primary pressure and secondary pressure.	Clean or replace the front attachment control valve.

The front attachment works slowly, or its power is weak

Causes	Inspections	Actions
The main pump is malfunctioning.	Measure the flow rate of the main pump.	Repair or replace the main pump.
The main relief valve is clogged by contamination.	Measure the main relief valve pressure.	Clean or replace the main relief valve.
The unload relief valve is clogged by contamination.	Measure the unload relief valve pressure.	Clean or replace the unload relief valve.
The HST filter is clogged by contamination.	—	Replace the HST filter.
The check valve of the HST filter is open.	Remove the check valve and check for contamination.	Clean or replace the check valve.

The hydraulic quick hitch does not work properly

Causes	Inspections	Actions
The hydraulic quick hitch solenoid valve is malfunctioning.	Check if the spools of the hydraulic quick hitch solenoid valve are stuck.	Clean or replace the hydraulic quick hitch solenoid valve.
The hydraulic quick hitch switch is broken.	Check for conduction of the hydraulic quick hitch switch.	Replace the hydraulic quick hitch switch.
The wire harness or connectors are broken.	Check for conduction of the wire harness and connectors.	Repair or replace the wire harness or connectors.

The high-flow function does not work

Causes	Inspections	Actions
The high-flow pump is malfunctioning.	Measure the flow rate of high-flow pump.	Repair or replace the high-flow pump.
The high-flow relief valve is clogged by contamination.	Measure the high-flow relief valve pressure.	Clean or replace the high-flow relief valve.
The high-flow solenoid valve is malfunctioning.	Check if the spool of the high-flow solenoid valve is stuck.	Clean or replace the high-flow solenoid valve.
The HST filter is clogged by contamination.	—	Replace the HST filter.
The high-flow switch is broken.	Check for conduction of the high-flow switch.	Replace the high-flow switch.
The wire harness or connectors are broken.	Check for conduction of the wire harness or connectors.	Repair or replace the wire harness or connectors.

The float function does not work properly

Causes	Inspections	Actions
The proportional solenoid (float) of the control valve is malfunctioning.	Check if the solenoid is malfunctioning.	Clean or replace the solenoid.
The spool of the float section is stuck.	Check if the spool is stuck.	Clean or replace the spool.
The float switch is broken.	Check for conduction in the tester mode (no.33).	Replace the float switch.
The lift arm pressure switch (lifting or lowering) is broken.	Check for conduction in the tester mode (no.34 and no.35).	Replace the lift arm pressure switch.
The wire harness or connectors are broken.	Check for conduction of the wire harness or connectors.	Repair or replace the wire harness or connectors.

The self-leveling function does not work properly

Causes	Inspections	Actions
The self-leveling solenoid valve is malfunctioning.	Check if the self-leveling solenoid valve is malfunctioning.	Clean or replace the self-leveling solenoid valve.
The adjustment of the separation ratio adjustment valve is wrong.	Measure the self-leveling angle.	Adjust the separation ratio adjustment valve.
The fuse (5 A control element) is broken.	Check for conduction of the fuse.	Replace the fuse.
The self-leveling switch is broken.	Check for conduction of the self-leveling switch.	Replace the self-leveling switch.
The diode is broken.	Check for conduction of the diode.	Replace the diode.
The wire harness or connectors are broken.	Check for conduction of the wire harness or connectors.	Repair or replace the wire harness or connectors.

1.2 Hydraulic system troubleshooting for the HST system

The machine does not travel, or the travel speed is low

Causes	Inspections	Actions
The HST pump is malfunctioning.	Measure the HST pump flow rate.	Repair or replace the HST pump.
The pilot line filter of the travel control valve is clogged by contamination.	Remove the pilot line filter and check for contamination.	Clean the pilot line filter.
The travel control valve is malfunctioning.	Measure the pilot primary pressure and secondary pressure.	Clean or replace the travel control valve.
The unload relief valve is clogged by contamination.	Measure the unload relief pressure.	Clean or replace the unload relief valve.
The parking brake is not released.	Measure the pressures at the P port and the A1 port of the unload valve.	Clean or replace the unload valve.
The parking brake switch is broken.	Check for the conduction in the tester mode (no.30).	Replace the parking brake switch.
The wire harness or connectors are broken.	Check for the conduction of the wire harness and connectors.	Repair or replace the wire harness or connectors.

The travel speed does not shift

Causes	Inspections	Actions
The travel speed shift solenoid valve of the unload valve is malfunctioning.	Measure the pressures at the P port and the A2 port of the unload valve.	Clean or replace the unload valve.
The travel speed shift switch is broken.	Check for the conduction in the tester mode (no.20).	Replace the travel speed shift switch.
The wire harness or connectors are broken.	Check for the conduction of the wire harness and connectors.	Repair or replace the wire harness or connectors.

The machine does not travel straight

Causes	Inspections	Actions
The tension of the rubber track is too loose or tight.	Check for the tension of the rubber tracks.	Adjust the tension of the rubber tracks.
The traveling unit is clogged with dirt.	Check if the traveling unit is clogged with dirt.	Clean the traveling unit.
The maximum angle of the HST pump swash plate is adjusted incorrectly.	—	Adjust the angle of the HST pump swash plate.
One or more of the high pressure relief valves are clogged by contamination, or their setting pressure is wrong.	Measure the pressures of the high pressure relief valves.	Clean or replace the high pressure relief valves.
The travel control valve is malfunctioning.	Measure the pilot primary pressure and secondary pressure.	Clean or replace the travel control valve.
The orifices of the M4, M5, M14, M15 port are clogged by contamination.	Remove the orifice and check for contamination.	Clean the orifice.
The HST pump is malfunctioning.	Measure the flow rate of the HST pump.	Repair or replace the HST pump.
The HST motor is malfunctioning.	Measure the flow rate of the HST motor.	Repair or replace the HST motor.

The machine creeps when not being operated

Causes	Inspections	Actions
The neutral position of the servo piston is wrong.	—	Adjust the neutral position of the servo piston.

The machine creeps when parked on a slope

Causes	Inspections	Actions
The parking brake spring is broken.	Check the parking brake spring.	Replace the parking brake spring.
The friction plate is worn.	Check the thickness of the friction plate.	Replace the friction plate.

2. Service specifications

2.1 Service specifications for hydraulic system

■ NOTE

- Standard measurement condition is as follows:
 - Hydraulic oil and devices temperature: 50 °C (including motor, pump, and cylinders)
 - Engine speed: Maximum
 - Hydraulic cylinder speed does not include cushioning.

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Flow rate	HST pump		L/min U.S.gals/min	72.0 19.0	—	57.6 15.2
	Main pump		L/min U.S.gals/min	69.8 18.4	—	55.8 14.7
	High-flow pump		L/min U.S.gals/min	38.5 10.2	—	30.8 8.2
	Charge pump		L/min U.S.gals/min	32.7 8.6	—	26.2 6.9
	AUX port	Normal flow	L/min U.S.gals/min	70.0 18.5	—	56.0 14.8
		High-flow	L/min U.S.gals/min	106.5 28.1	—	85.2 22.5
Pressure	Main relief valve	Main pump (aP1)	MPa kgf/cm ² psi	22.4 228 3250	—	—
		High-flow pump (aP2)	MPa kgf/cm ² psi	20.3 207 2940	—	—
		Charge pump (aPP)	MPa kgf/cm ² psi	4.6 47 670	—	—
		High pressure relief valve (HST motor LH forward movement) (aLF)	MPa kgf/cm ² psi	37.5 382 5440	±1.5 ±15 ±220	—
		High pressure relief valve (HST motor LH backward movement) (aLB)	MPa kgf/cm ² psi	37.5 382 5440	±1.5 ±15 ±220	—
		High pressure relief valve (HST motor RH forward movement) (aRF)	MPa kgf/cm ² psi	37.5 382 5440	±1.5 ±15 ±220	—

(Continued)

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Pressure	Main relief valve	High pressure relief valve (HST motor RH backward movement) (aRB)	MPa kgf/cm ² psi	37.5 382 5440	±1.5 ±15 ±220	—
	Overload relief valve	Lift arm cylinder bottom (b1B)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		Lift arm cylinder rod (b1R)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		Bucket cylinder bottom (b2B)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		Bucket cylinder rod (b2R)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		AUX port male (b3M)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		AUX port female (b3F)	MPa kgf/cm ² psi	25.0 255 3630	—	—
	Pilot pressure	Charge relief valve (pCR)	MPa kgf/cm ² psi	3.7 38 540	—	—
		Unload relief valve (pUR)	MPa kgf/cm ² psi	4.0 41 580	—	—
	Pilot primary pressure	Front attachment control valve	MPa kgf/cm ² psi	3.8 39 550	—	—
		Travel control valve	MPa kgf/cm ² psi	2.6 27 380	—	—
	Pilot secondary pressure	Front attachment control valve	MPa kgf/cm ² psi	3.5 36 510	—	—
		Travel control valve	MPa kgf/cm ² psi	2.1 21 300	—	—
Internal leakage	Lift arm cylinder		mm in.	Less than 27 Less than 1.1	—	105 5.5
	Bucket cylinder		mm in.	Less than 20 Less than 0.8	—	100 4.0
	HST motor	When the machine is facing up the slope	mm in.	0 0	—	—
		When the machine is facing down the slope	mm in.	0 0	—	—
Speed	Lift arm cylinder	Raising	s	4.0	±0.2	—

(Continued)

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Speed	Lift arm cylinder	Lowering	s	2.5	±0.2	—
	Bucket cylinder	Crowding	s	1.6	±0.2	—
		Dumping	s	2.1	±0.2	—
	Traveling	Low speed	s/20 m	9.2	±0.9	—
		High speed	s/20 m	6.3	±0.6	—
Others	Travel straightness *1	Low speed	rpm	2.5	—	—
		High speed	rpm	5.5	—	—
	Self-leveling angle *2	At the highest position	degree	—	-2 to +6	—

*1: The difference of the rotation number between the HST motor LH and RH.

*2: "+" indicates that the front attachment inclines to the crowding side, and "-" indicates that the front attachment inclines to the dumping side, when viewed from the side.

3. Testing

3.1 Measuring the hydraulic devices

3.1.1 Measuring the lift arm cylinder speed



CAUTION

- Keep any persons or objects away from the machine.

Measuring

- Park the machine on the firm and level ground.
- Warm up the hydraulic oil and devices to 50±5 °C (122±9 °F).
- Crowd the bucket to the stroke end, and lower the lift arm.
- Accelerate the engine to the maximum speed.
- Raise the lift arm to the stroke end in full-stroke operation to measure the lift arm cylinder raising speed.

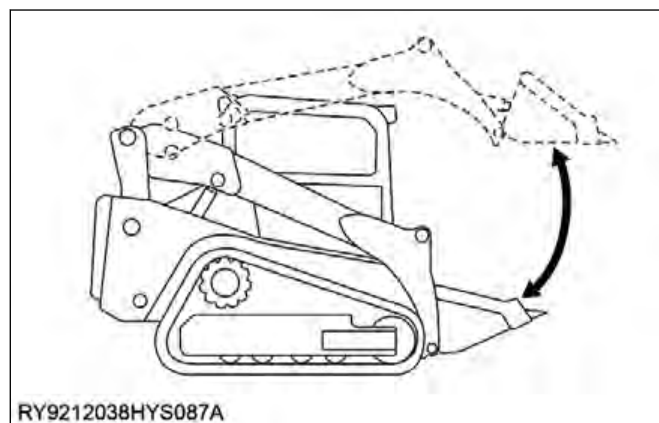
NOTE

- Check that the self-leveling switch is turned off.

- Measure 3 times to calculate the average.
- Measure the lift arm cylinder lowering speed as well.

NOTE

- Do not include the cushion range when measuring the lowering speed.



Service specifications

Lift arm cylinder speed	Raising	3.8 to 4.2 s
	Lowering	2.3 to 2.7 s

3.1.2 Measuring the bucket cylinder speed



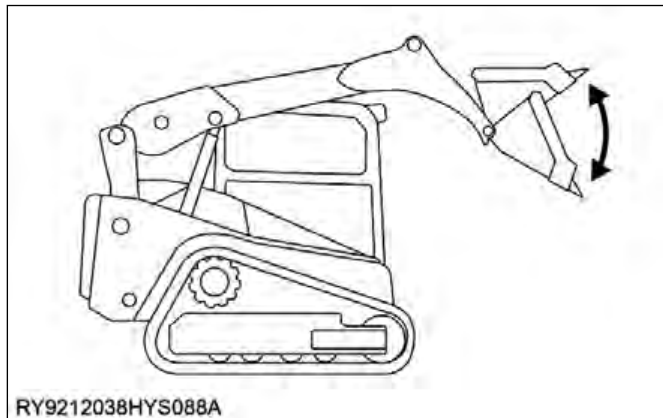
CAUTION

- Keep any persons or objects away from the machine.

Measuring

- Park the machine on the firm and level ground.
- Warm up the hydraulic oil and devices to 50±5 °C (122±9 °F).
- Raise the lift arm cylinder to the stroke end, and dump the bucket to the stroke end.
- Accelerate the engine to the maximum speed.
- Crowd the bucket to the stroke end in full-stroke operation to measure the bucket cylinder crowding speed.
- Measure 3 times to calculate the average.

7. Measure the bucket cylinder dumping speed as well.



Service specifications

Bucket cylinder speed	Crowding	1.4 to 1.8 s
	Dumping	1.9 to 2.3 s

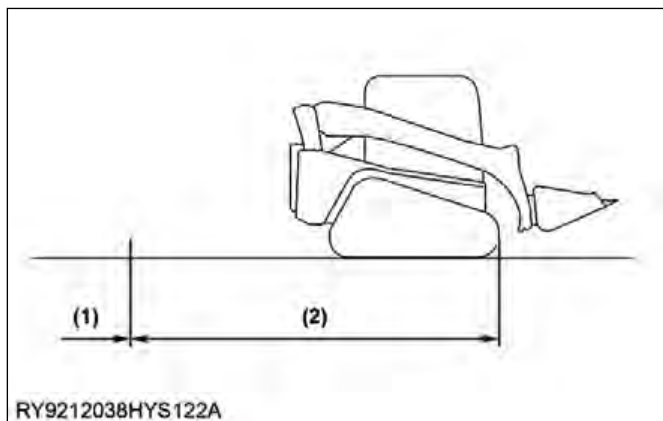
3.1.3 Measuring the travel speed

CAUTION

- Keep any persons or objects away from the machine.

Measuring

- Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
- Crowd the bucket to the stroke end, and place the lift arm 300 mm (11.8 in.) above the ground.
- Accelerate the engine to the maximum speed.
- Perform an approach run for 5 m (16.4 ft) with operating the travel control lever in full stroke, and then measure the time for traveling 20 m (65.6 ft) at the maximum speed.
- Measure 3 times to calculate the average.



- (1) Approach distance (5 m, 16.4 ft) (2) Measuring distance (20 m, 65.6 ft)

Service specifications

Travel speed	Low speed (forward and backward)	8.3 to 10.1 s/20 m
	High speed (forward and backward)	5.7 to 6.9 s/20 m

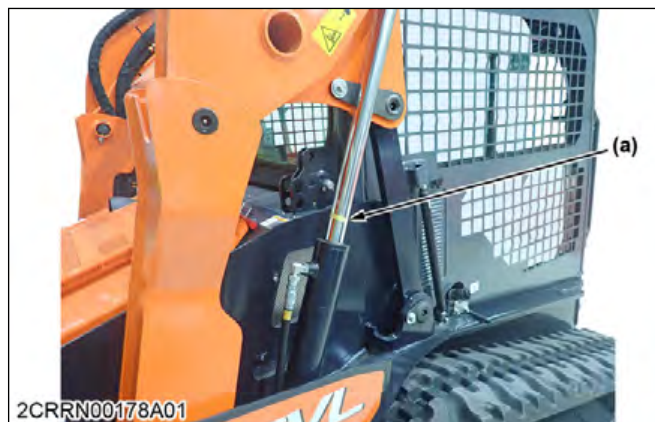
3.1.4 Measuring the cylinder internal leakage

CAUTION

- Keep any persons or objects away from the machine.

Measuring

- Park the machine on the firm and level ground.
- Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
- Raise the lift arm to the stroke end, and make the angle of the bottom of the bucket horizontal.
- Stop the engine.
- Put marks on the lift arm cylinder rod and the bucket cylinder rod.



(a) Mark

- Measure the internal leakage for each cylinder after waiting for 10 minutes.

■ **NOTE**

- Measure the compressed length of the rod for the lift arm cylinder.
- Measure the extended length of the rod for the bucket cylinder.

7. Measure 3 times to calculate the average.

Service specifications

Internal leakage	Lift arm cylinder	Less than 27 mm Less than 1.1 in.
	Bucket cylinder	Less than 20 mm Less than 0.8 in.

Service limit

Internal leakage	Lift arm cylinder	105 mm 5.5 in.
	Bucket cylinder	100 mm 4.0 in.

3.1.5 Measuring the HST motor internal leakage

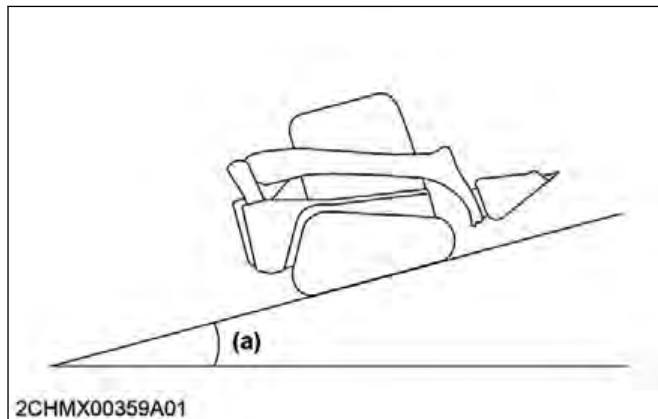


CAUTION

- Keep any persons or objects away from the machine.

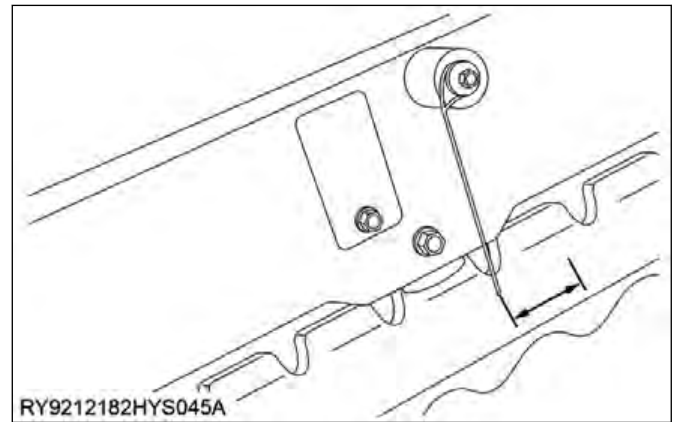
Measuring

1. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
2. Park the machine on the firm slope angled at 15 degrees.
3. Crowd the bucket to the stroke end, and place the lift arm 300 mm (11.8 in.) above the ground.
4. Stop the engine.



(a) 15 degrees

5. Put a mark on the rubber track and the machine.



6. After waiting for 1 minute, measure the internal leakage between the rubber track and the machine.
7. Measure 3 times to calculate the average.

Service specifications

Internal leakage	When the machine is facing up the slope	0 mm 0 in.
	When the machine is facing down the slope	0 mm 0 in.

3.1.6 Testing the travel straightness



CAUTION

- Keep any persons or objects away from the machine.

Measuring

1. Park the machine on the firm and level ground.
2. Jack up the machine.
3. Put a marker on the HST motor, and set the rotation measuring device.



(1) HST motor

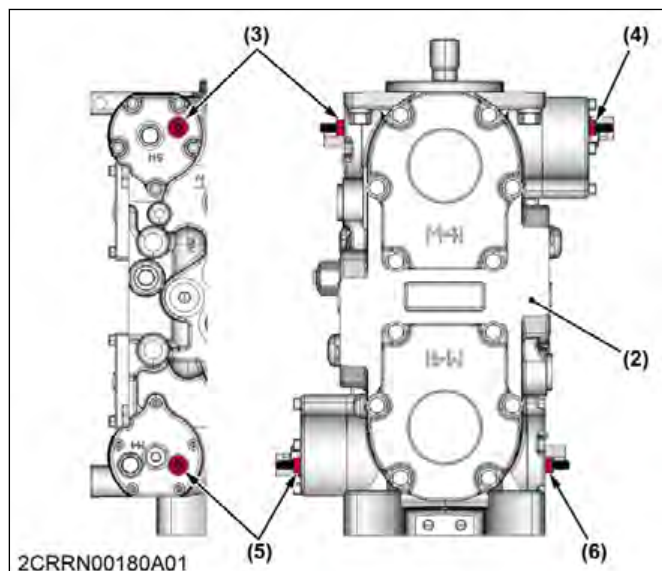
(A) Marker

4. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
5. Accelerate the engine to the maximum speed.
6. Operate the travel control lever in full stroke, and measure the number of rotation.

7. Measure 3 times to calculate the average.
8. Measure the opposite side in the same way.
9. Calculate the difference between LH and RH.

Service specifications

Travel straightness (difference between LH and RH)	Low speed	2.5 rpm
	High speed	5.5 rpm

Adjusting

- | | |
|--|--|
| (2) HST pump | (5) Adjusting screw (HST motor RH forward movement) |
| (3) Adjusting screw (HST motor LH forward movement) | (6) Adjusting screw (HST motor RH backward movement) |
| (4) Adjusting screw (HST motor LH backward movement) | |

NOTE

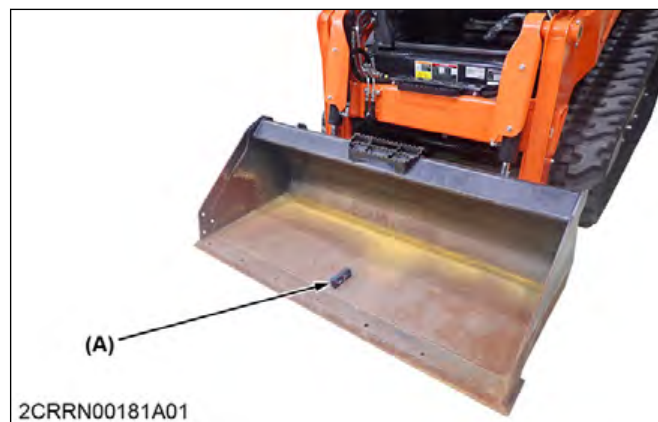
- Loosen the nut, and adjust the set screw.
 - Rotating the set screw to the right: decreases the traveling speed
 - Rotating the set screw to the left: increases the traveling speed

3.1.7 Measuring the self-leveling**CAUTION**

- Keep any persons or objects away from the machine.

Measuring

1. Park the machine on the firm and level ground.
2. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
3. Lower the front attachment to the ground. Make the bottom angle of the bucket horizontal.
4. Set an angle gauge on the bucket.



(A) Angle gauge

5. Turn on the self-leveling switch.
6. Accelerate the engine to the maximum speed.
7. Raise the lift arm to the stroke end in full-stroke operation to measure the self-leveling angle.
8. Check the angle gauge by using a stepladder while the lift arm is at the stroke end.



9. Measure 3 times to calculate the average.

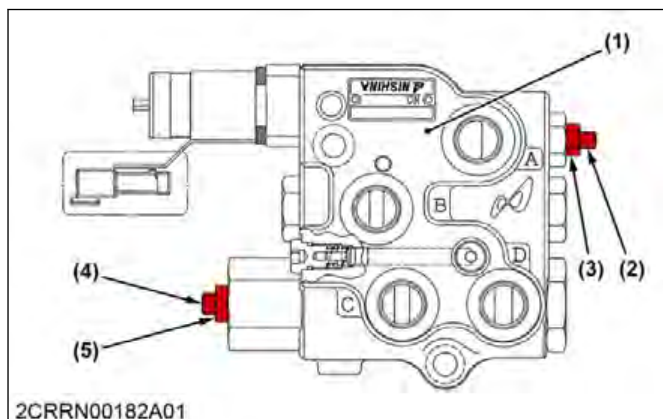
Service specifications

Self-leveling angle	No load on the bucket	-2 to +6°
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NOTE

- "+" indicates that the front attachment inclines to the crowding side, and "-" indicates that the front attachment inclines to the dumping side, when viewed from the side.

Adjusting



- (1) Self-leveling solenoid valve (4) Adjusting screw of the stopper
(2) Adjusting screw of the flow divide adjustment valve (5) Nut
(3) Nut

NOTE

- When adjusting the self-leveling angle, adjust the adjusting screw of the flow divide adjustment valve.
 - Remove the battery before adjusting.
 - Tighten: The angle increases.
 - Loosen: The angle decreases.
- When adjusting the self-leveling start timing, adjust the adjusting screw of the stopper.
 - Tilt up the cab before adjusting.
 - Tighten: The start timing is delayed.
 - Loosen: The start timing is advanced.

Tightening torque

(3) Nut	8.8 to 10.8 N·m 0.90 to 1.10 kgf·m 6.5 to 7.8 lbf·ft	—
(5) Nut	16.7 to 20.5 N·m 1.70 to 2.09 kgf·m 12.3 to 15.1 lbf·ft	—

3.2 Measuring the HST pump

3.2.1 Measuring the HST pump flow rate



CAUTION

- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

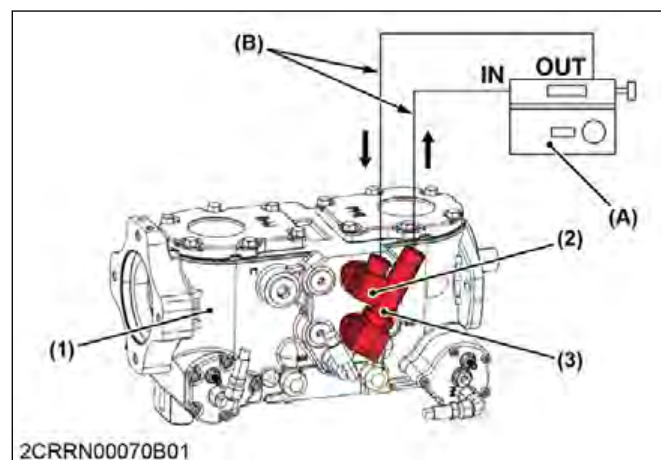
- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

- Park the machine on the firm and level ground.

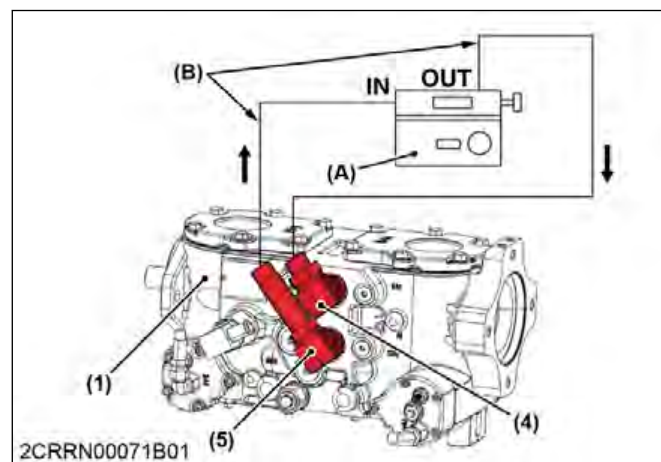
- Jack up the machine.
- Lower the front attachment to the ground and stop the engine.
- Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
- Disconnect the delivery hose from the HST pump.
- Connect the test hose to the flow meter and the HST pump.
- Remove the vacuum pump and check for oil leakage.

HST motor LH when traveling forward



- (1) HST pump (A) Flow meter
(2) Port A (HST motor LH backward movement) (B) Test hose
(3) Port B (HST motor LH forward movement)

HST motor RH when traveling forward



- (1) HST pump (A) Flow meter
(4) Port C (HST motor RH backward movement) (B) Test hose
(5) Port D (HST motor RH forward movement)

NOTE

- When traveling backward, switch the test hose of the flow meter each other.

Measuring

- Open the loading valve (restrictor valve) of the flow meter completely.

6. HYDRAULIC SYSTEM

2. Start up the engine, and accelerate it to the maximum speed.
3. Warm up the hydraulic oil and the HST pump to 50 ± 5 °C (122 ± 9 °F).
4. Operate the travel control lever gradually to its full stroke.
5. Measure the flow rate 3 times to calculate the average.

Service specification

HST pump flow rate	72.0 L/min 19.0 U.S.gals/min
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Service limit

HST pump flow rate	57.6 L/min 15.2 U.S.gals/min
--------------------	---------------------------------

3.2.2 Measuring the high pressure relief valve pressure

CAUTION

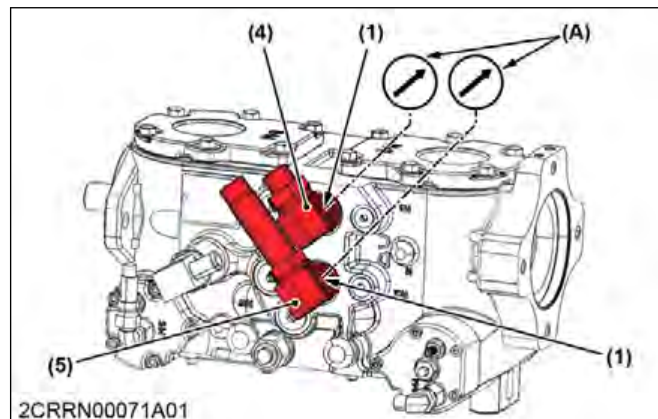
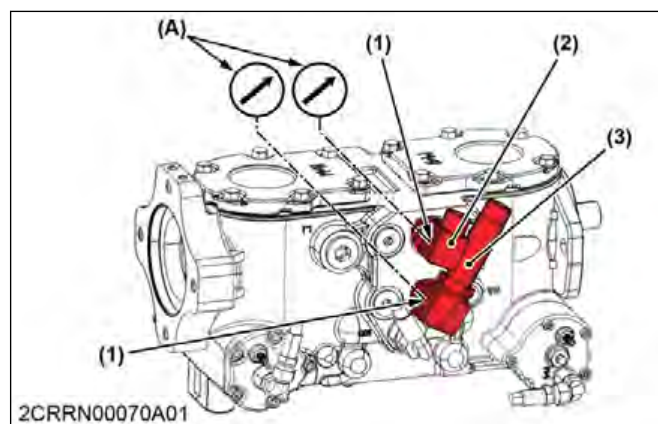
- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

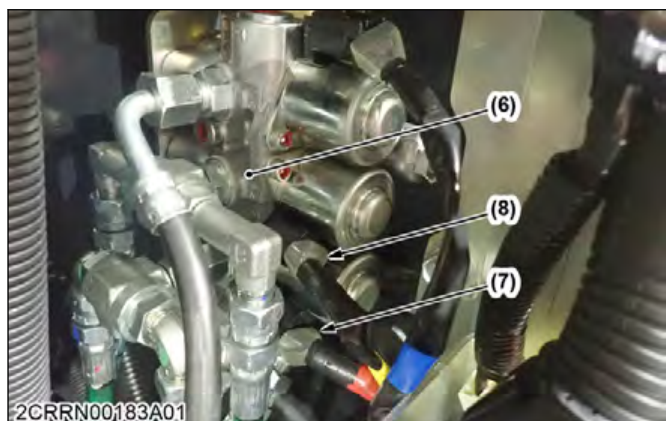
Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Remove the plugs at each detection port of the HST pump, and attach a pressure gauge to each detection port.
5. Remove the vacuum pump and check for oil leakage.



- | | |
|---|--|
| (1) Detection port | (5) Port D (HST motor RH forward movement) |
| (2) Port A (HST motor LH backward movement) | (A) Pressure gauge |
| (3) Port B (HST motor LH forward movement) | |
| (4) Port C (HST motor RH backward movement) | |

6. Switch the parking brake connector and the travel speed shift connector of the unload valve.



(6) Unload valve
(7) Parking brake connector
(8) Travel speed shift connector

Measuring

1. Start up the engine, and accelerate it to the maximum speed.
2. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
3. Operate the travel control lever gradually to its full stroke.
4. Measure the relief pressure 3 times to calculate the average.

IMPORTANT

- Do not stand in front of or behind the machine.
- Make sure to restore the connectors of the unload valve after measuring.

Service specification

High pressure relief valve pressure	36.0 to 39.0 MPa 367 to 398 kgf/cm ² 5220 to 5660 psi
-------------------------------------	--

3.2.3 Measuring the charge relief valve pressure

CAUTION

- Keep any persons or objects away from the machine.

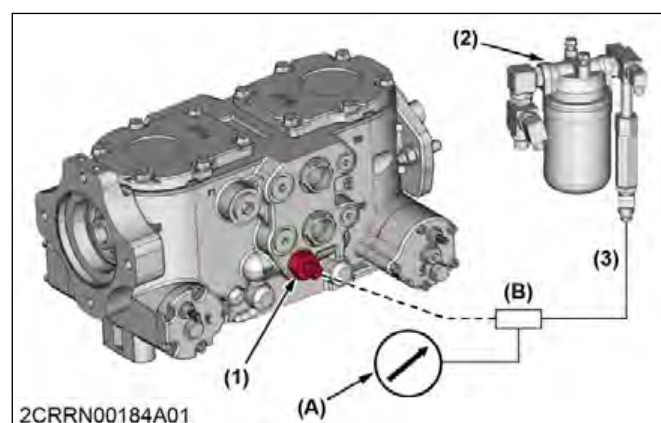
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Disconnect the delivery hose from port M6 of the HST pump, and install an adapter to port M6.
5. Connect the delivery hose to the adapter and attach a pressure gauge to the adapter.
6. Remove the vacuum pump and check for oil leakage.



(1) HST pump (port M6)
(2) HST filter
(3) Delivery hose
(A) Pressure gauge
(B) Adapter

Measuring

1. Start up the engine, and accelerate it to the maximum speed.
2. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
3. Measure the relief pressure 3 times to calculate the average.

Service specification

Charge relief valve pressure	3.7 MPa 38 kgf/cm ² 540 psi
------------------------------	--

3.3 Measuring the main pump

3.3.1 Measuring the main pump flow rate

CAUTION

- Keep any persons or objects away from the machine.

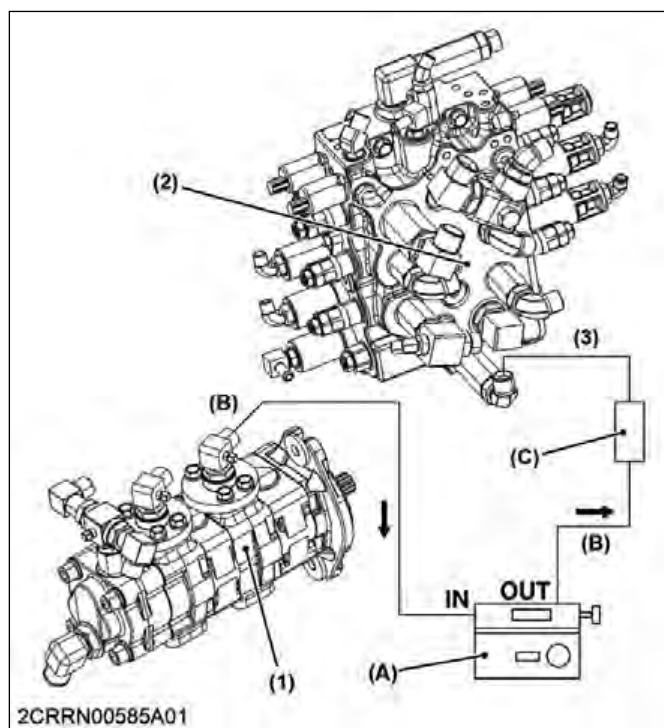
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Disconnect the delivery hose from the main pump, and connect it to the flow meter with an adapter and the test hose.
5. Connect the test hose to the flow meter and the main pump.



- (1) Main pump
(2) Control valve
(3) Delivery hose
(A) Flow meter
(B) Test hose
(C) Adapter

Measuring

1. Open the loading valve (restrictor valve) of the flow meter completely.
2. Start up the engine, and accelerate it to the maximum speed.
3. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
4. Measure the flow rate 3 times to calculate the average.

Service specification

Main pump flow rate	69.8 L/min 18.4 U.S.gals/min
---------------------	---------------------------------

Service limit

Main pump flow rate	55.8 L/min 14.7 U.S.gals/min
---------------------	---------------------------------

3.3.2 Measuring the AUX flow rate**CAUTION**

- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

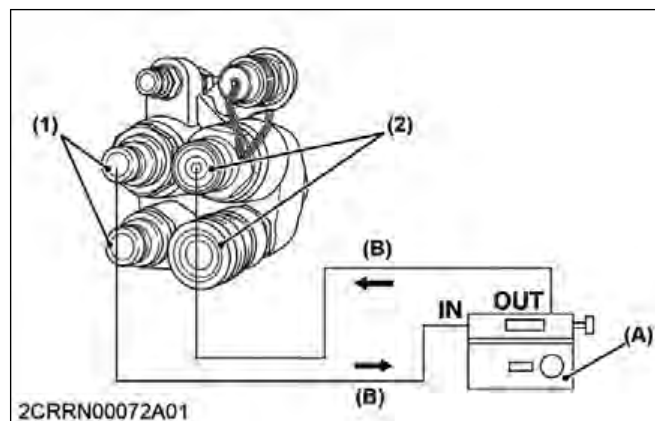
- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Disconnect the hoses from the AUX outlet port if necessary.
4. Connect the test hoses to the flow meter and AUX outlet port.

NOTE

- When measuring the flow rate to the opposite direction, switch the test hoses connected to the male port and female port.

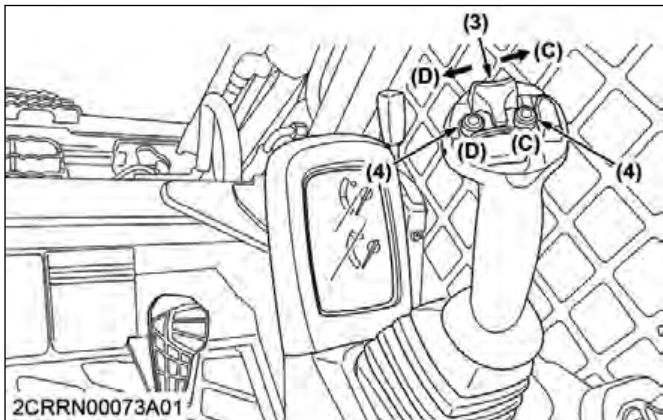


- (1) Male port
(2) Female port
(A) Flow meter
(B) Test hose

Measuring

1. Open the loading valve (restrictor valve) of the flow meter completely.

2. Start up the engine, and accelerate it to the maximum speed.
3. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
4. Operate the AUX variable switch in its full stroke.



- (3) AUX variable switch
(4) AUX hold switch
(C) Right
(D) Left

5. Measure the flow rate 3 times to calculate the average.

NOTE

- When pressing the AUX hold switch, be careful not to damage the flow meter.

Service specification

AUX flow rate	Normal flow	70.0 L/min 18.5 U.S.gals/min
	High-flow	106.5 L/min 28.1 U.S.gals/min

Service limit

AUX flow rate	Normal flow	56.0 L/min 14.8 U.S.gals/min
	High-flow	85.2 L/min 22.5 U.S.gals/min

3.4 Measuring the high-flow pump

3.4.1 Measuring the high-flow pump flow rate



CAUTION

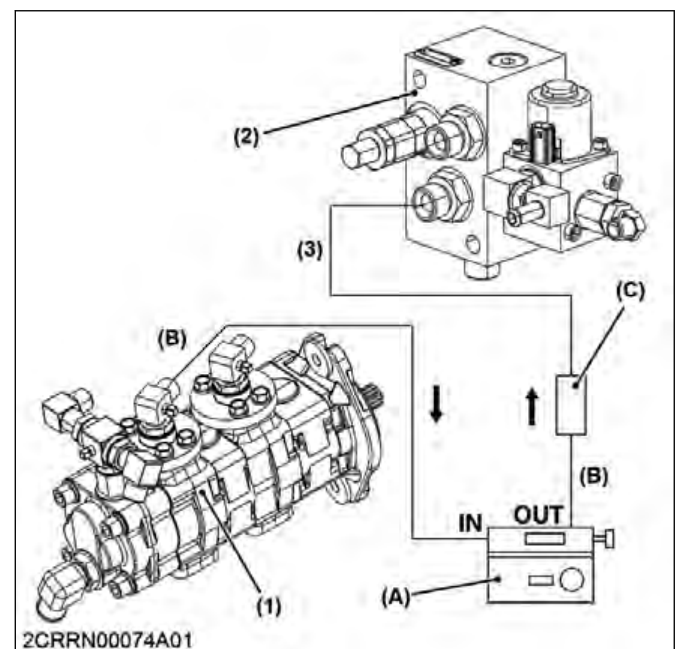
- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Disconnect the delivery hose from the high-flow pump, and connect it to the flow meter with an adapter and the test hose.
5. Connect the test hose to the flow meter and the high-flow pump.



- (1) High-flow pump
(2) High-flow solenoid valve
(3) Delivery hose
(A) Flow meter
(B) Test hose
(C) Adapter

Measuring

1. Open the loading valve (restrictor valve) of the flow meter completely.
2. Start up the engine, and accelerate it to the maximum speed.
3. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
4. Measure the flow rate 3 times to calculate the average.

Service specification

High-flow pump flow rate	38.5 L/min 10.2 U.S.gals/min
--------------------------	---------------------------------

Service limit

High-flow pump flow rate	30.8 L/min 8.2 U.S.gals/min
--------------------------	--------------------------------

3.4.2 Measuring the high-flow relief pressure

CAUTION

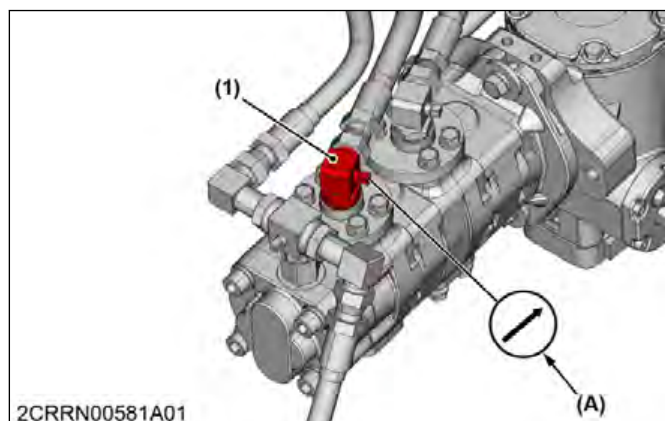
- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

- Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground, remove an AUX attachment if installed, and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Install a pressure gauge to the detection port on the high-flow pump.



(1) Detection port

(A) Pressure gauge

5. Remove the vacuum pump and check for oil leakage.

Measuring

1. Start up the engine, and accelerate to the maximum speed.
2. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
3. Activate the AUX and high-flow.
4. Gradually tilt the AUX knob switch to the RH end to relieve the high-flow valve.



(2) AUX knob switch

5. Measure the pressure 3 times to calculate the average.

Service specification

High-flow relief pressure	20.3 MPa 207 kgf/cm ² 2940 psi
---------------------------	---

3.5 Measuring the charge pump

3.5.1 Measuring the charge pump flow rate

CAUTION

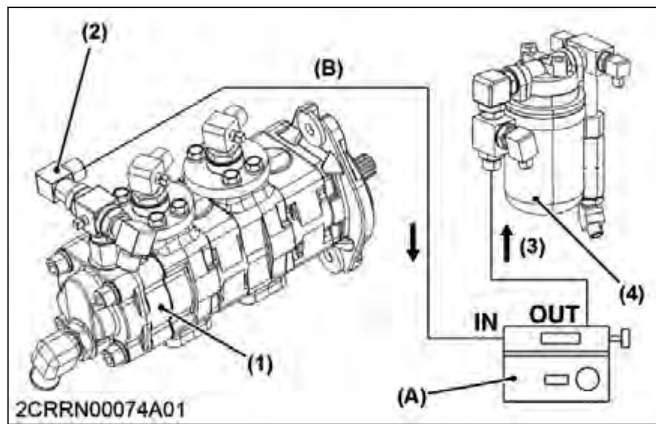
- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Disconnect the delivery hose of the charge pump.
5. Connect the delivery hose to the [OUT] port of the flow meter.
6. Connect the test hose to the [IN] port of the flow meter, and the delivery port of the charge pump.
7. Remove the vacuum pump and check for oil leakage.



- (1) Charge pump
(2) Delivery port
(3) Delivery hose
(4) HST filter
(A) Flow meter
(B) Test hose

Measuring

1. Open the loading valve (restrictor valve) of the flow meter completely.
2. Start up the engine, and accelerate it to the maximum speed.
3. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
4. Measure the flow rate 3 times to calculate the average.

Service specification

Charge pump flow rate	32.7 L/min 8.6 U.S.gals/min
-----------------------	--------------------------------

Service limit

Charge pump flow rate	26.2 L/min 6.9 U.S.gals/min
-----------------------	--------------------------------

3.5.2 Measuring the charge pump relief pressure



CAUTION

- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

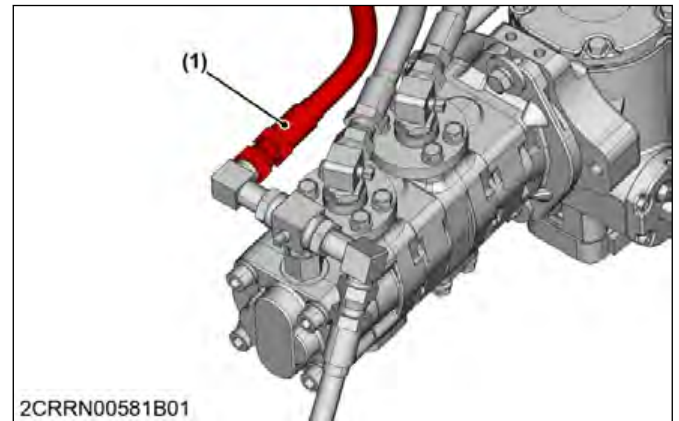
IMPORTANT

- Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

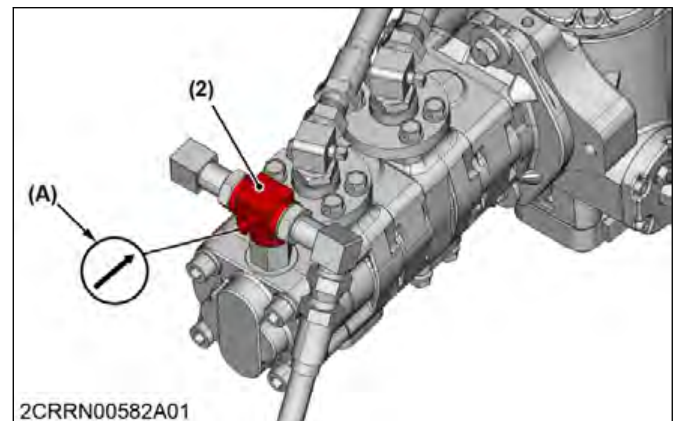
1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.

4. Remove the delivery hose from the charge pump.



- (1) Delivery hose

5. Install a pressure gauge to the detection port on the charge pump.



- (2) Detection port
(A) Pressure gauge

6. Remove the vacuum pump and check for oil leakage.

Measuring

1. Start up the engine, and accelerate it to the maximum speed.
2. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
3. Measure the pressure 3 times to calculate the average.

Service specification

Charge pump relief pressure	4.6 MPa 47 kgf/cm ² 670 psi
-----------------------------	--

3.6 Measuring the control valve

3.6.1 Measuring the main relief valve pressure



CAUTION

- Keep any persons or objects away from the machine.

6. HYDRAULIC SYSTEM

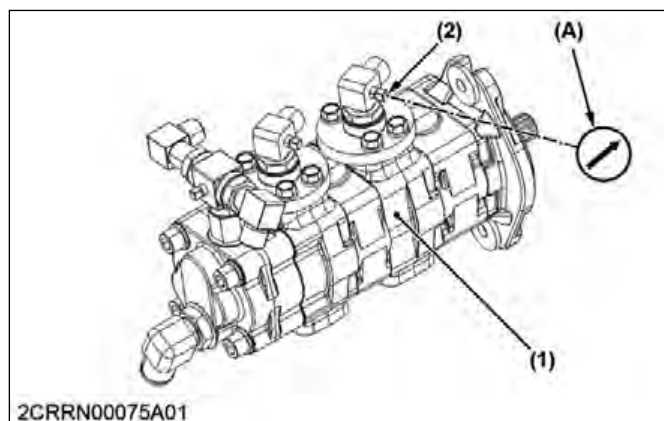
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

■ IMPORTANT

- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

- Park the machine on the firm and level ground.
- Lower the front attachment to the ground and stop the engine.
- Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
- Install the pressure gauge to the detection port.
- Remove the vacuum pump and check for oil leakage.



- (1) Main pump (A) Pressure gauge
(2) Detection port

Measuring

- Start up the engine, and accelerate it to the maximum speed.
- Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
- Operate the front attachment control lever to the left in its full stroke.
- Measure the relief pressure 3 times to calculate the average.

Service specification

Main relief valve pressure (aP1)	22.4 MPa 228 kgf/cm ² 3250 psi
-------------------------------------	---

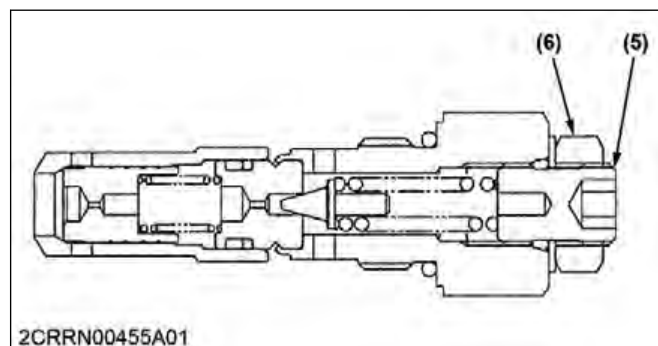
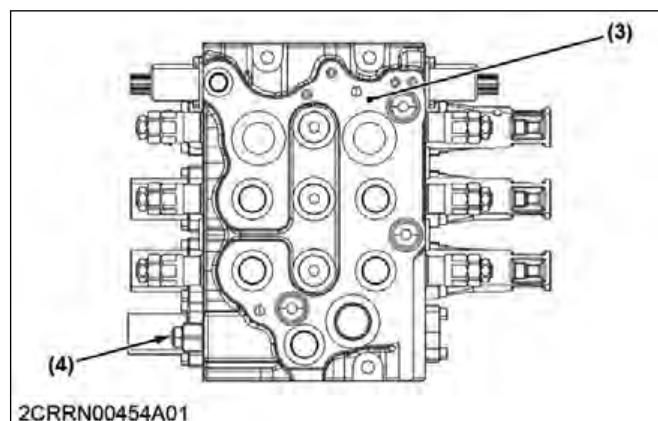
Adjusting

- Loosen the locknut.
- Adjust the position of the adjusting screw and tighten the locknut.

■ NOTE

- Tighten: main relief pressure increases
- Loosen: main relief pressure decreases

- Main relief pressure changes by 17.7 MPa per revolution of the adjusting screw.



- (3) Control valve (6) Locknut
(4) Main relief valve
(5) Adjusting screw

Tightening torque

(6) Locknut	27 to 31 N · m 2.8 to 3.2 kgf · m 20 to 23 lbf · ft	—
-------------	---	---

- Operate the front attachment control lever while the engine speed is maximum, and check the main relief pressure.

3.6.2 Measuring the overload relief valve pressure



CAUTION

- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

■ IMPORTANT

- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

- Park the machine on the firm and level ground.

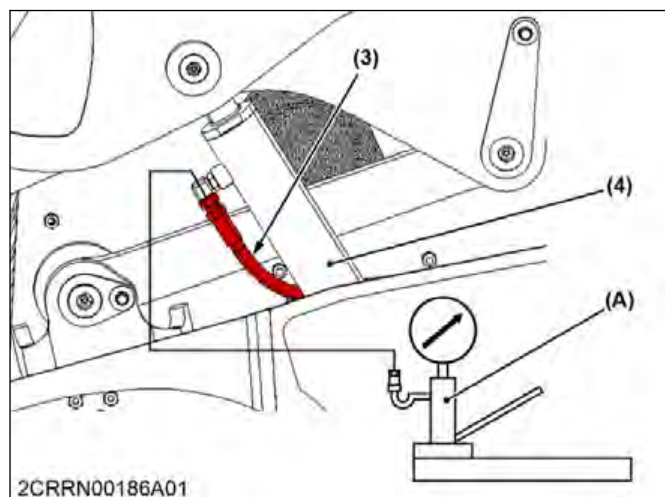
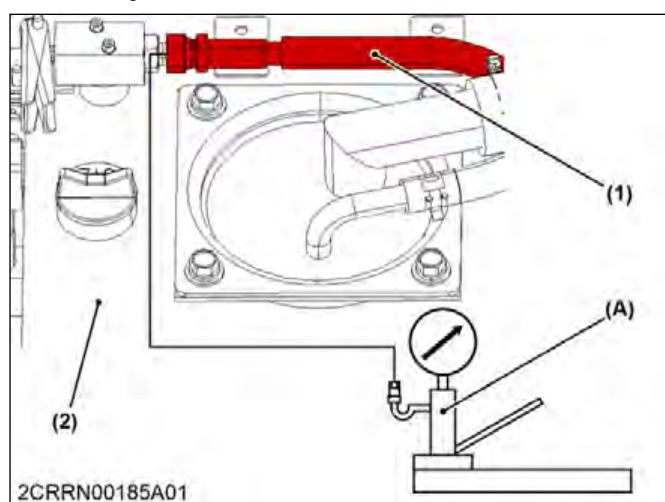
2. Lower the front attachment to the ground and stop the engine.
3. Disconnect the delivery hose which is connected to the control valve.

NOTE

- Check that the residual pressure is released before disconnecting the delivery hose.
- When measuring the bottom side of the lift arm cylinder, raise the lift arm to the stroke end and attach the lift arm stopper before disconnecting the delivery hose.

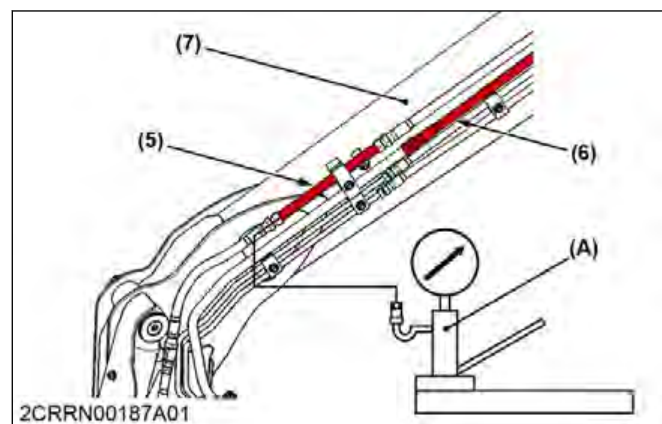
4. Connect the pressure measurement kit to the delivery hose or pipe.
5. Check for oil leakage.

Lift arm cylinder



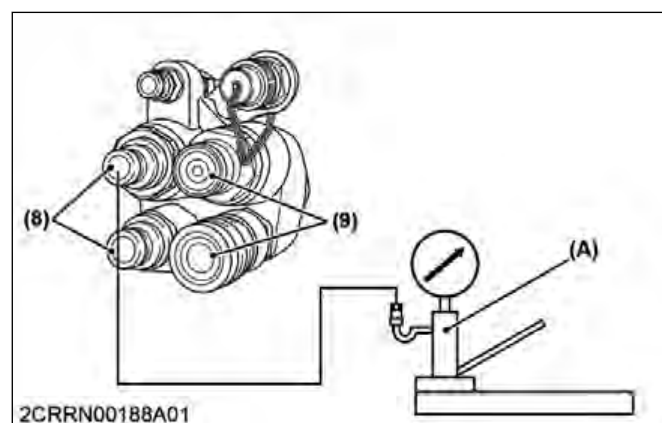
- | | |
|--|------------------------------|
| (1) Delivery hose (bottom side of the lift arm cylinder) | (4) Lift arm cylinder |
| (2) Hydraulic oil tank | (A) Pressure measurement kit |
| (3) Delivery hose (rod side of the lift arm cylinder) | |

Bucket cylinder



- | | |
|--|------------------------------|
| (5) Delivery pipe (bottom side of the bucket cylinder) | (7) Lift arm |
| (6) Delivery hose (rod side of the bucket cylinder) | (A) Pressure measurement kit |

AUX outlet port



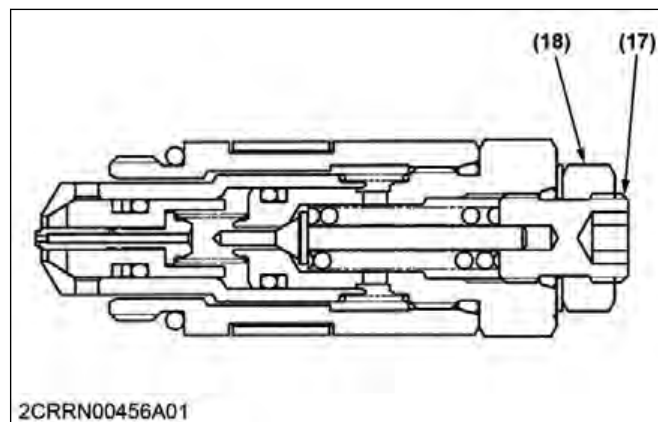
- | | |
|-----------------|------------------------------|
| (8) Male port | (A) Pressure measurement kit |
| (9) Female port | |

Measuring

1. Apply pressure to relieve the overload relief valve with the pressure measurement kit, and measure the pressure.
2. Measure the relief pressure 3 times to calculate the average.

Service specification

Overload relief valve pressure	Bottom side of the lift arm cylinder (b1B)	25.0 MPa 255 kgf/cm ² 3630 psi
	Rod side of the lift arm cylinder (b1R)	
	Bottom side of the bucket cylinder (b2B)	
	Rod side of the bucket cylinder (b2R)	
	AUX male port (b3M)	
	AUX female port (b3F)	



- (10) Control valve
 (11) Overload relief valve (b1B)
 (12) Overload relief valve (b1R)
 (13) Overload relief valve (b2B)
 (14) Overload relief valve (b2R)
 (15) Overload relief valve (b3F)
 (16) Overload relief valve (b3M)
 (17) Adjusting screw
 (18) Locknut

Adjusting

- Loosen the locknut.
- Adjust the position of the adjusting screw and tighten the locknut.

NOTE

- **Tighten: overload relief pressure increases**
- **Loosen: overload relief pressure decreases**
- **Overload relief pressure changes by 28.4 MPa per revolution of the adjusting screw.**

Tightening torque

(18) Locknut	28 to 31 N·m 2.9 to 3.2 kgf·m 21 to 23 lbf·ft	—
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- Check the overload relief pressure with the pressure measurement kit.

3.7 Measuring the unload valve**3.7.1 Measuring the unload valve relief pressure****CAUTION**

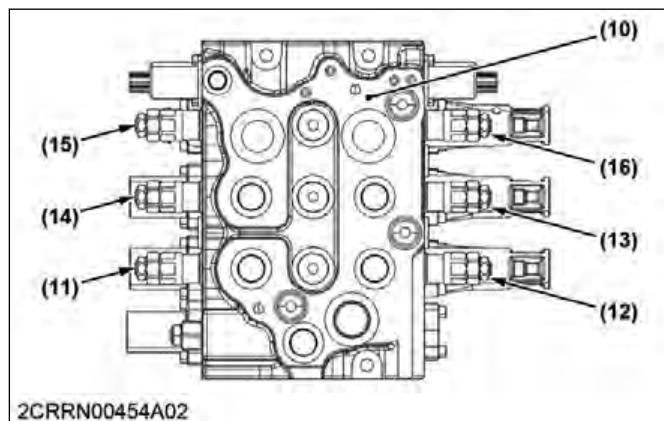
- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

- Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

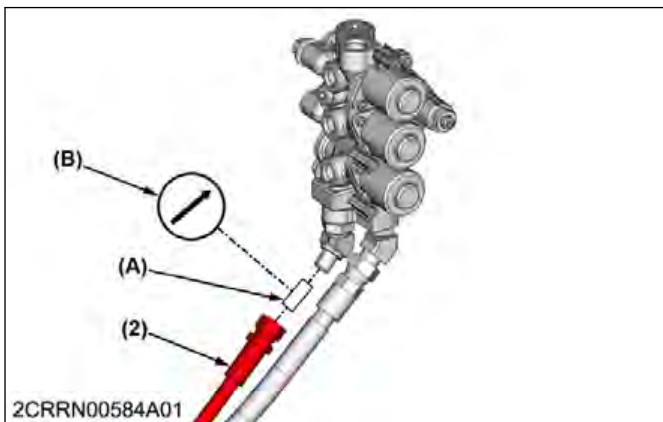
- Park the machine on the firm and level ground.
- Lower the front attachment to the ground and stop the engine.
- Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
- Remove the hydraulic hose which is connected to the charge port of the HST pump.





(1) Hydraulic hose

5. Install an adapter between the inlet hydraulic hose and unload valve, and attach a pressure gauge.



(2) Hydraulic hose

(B) Pressure gauge

(A) Adapter

6. Remove the vacuum pump and check for oil leakage.

Measuring

1. Start up the engine, and accelerate it to the maximum speed.
2. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
3. Measure the pressure 3 times to calculate the average.

Service specification

Unload valve relief pressure	4.0 MPa 40.8 kgf/cm ² 145 psi
------------------------------	--

3.8 Measuring pilot control valve

3.8.1 Measuring the pilot primary pressure



CAUTION

- Keep any persons or objects away from the machine.

- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

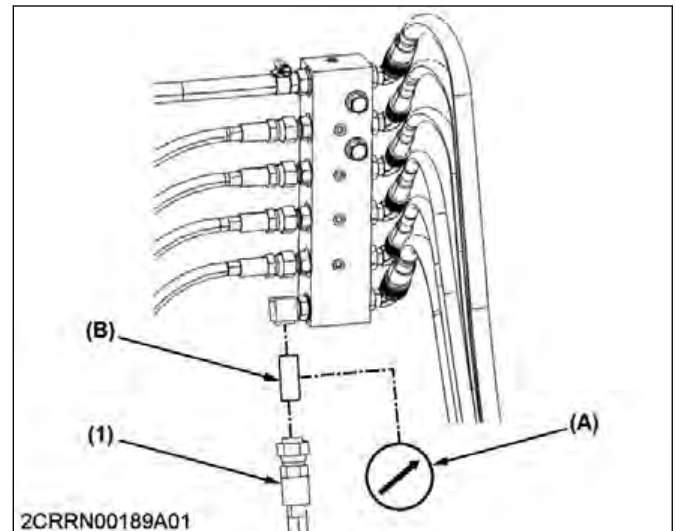
■ IMPORTANT

- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Install the adapter between the delivery hose and the joint, and attach a pressure gauge.
5. Remove the vacuum pump and check for oil leakage.

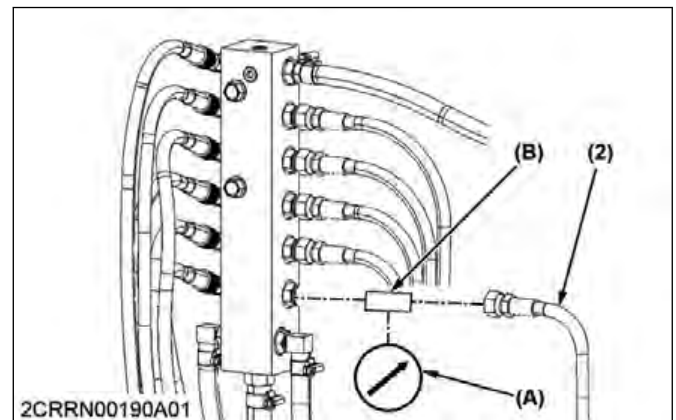
Travel control valve



(1) Delivery hose (travel control valve port P)

(A) Pressure gauge
(B) Adapter

Front attachment control valve



(2) Delivery hose (front attachment control valve port P)

(A) Pressure gauge
(B) Adapter

Measuring

1. Start up the engine, and accelerate to the maximum speed.
2. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
3. Press the hydraulic unlock switch.
4. Measure the pressure 3 times to calculate the average.

Service specification

Pilot primary pressure	Front attachment control valve	3.8 MPa 39 kgf/cm ² 550 psi
	Travel control valve	2.6 MPa 27 kgf/cm ² 380 psi

3.8.2 Measuring the pilot secondary pressure**CAUTION**

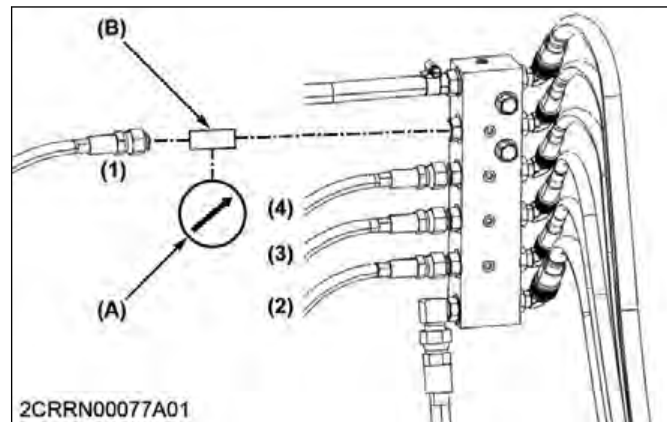
- Keep any persons or objects away from the machine.
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

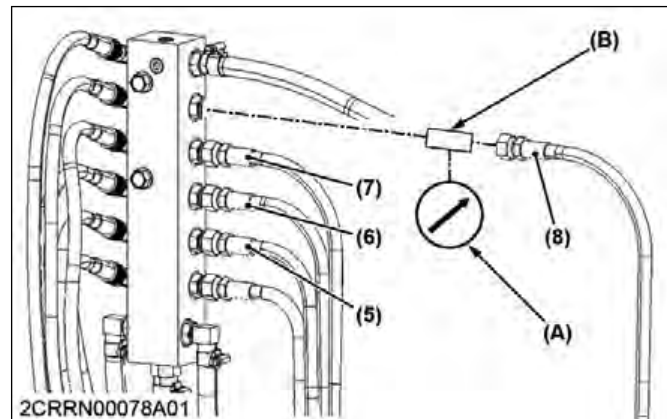
- Install the plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Install the adapters between the delivery hoses and the joints, and attach pressure gauges.
5. Remove the vacuum pump and check for oil leakage.

Travel control valve

- (1) Delivery hose (HST motor RH forward movement)
- (2) Delivery hose (HST motor LH forward movement)
- (3) Delivery hose (HST motor RH backward movement)
- (4) Delivery hose (HST motor LH backward movement)
- (A) Pressure gauge
- (B) Adapter

Front attachment control valve

- (5) Delivery hose (bucket crowd-in)
- (6) Delivery hose (lift arm lowering)
- (7) Delivery hose (bucket dumping)
- (8) Delivery hose (lift arm raising)
- (A) Pressure gauge
- (B) Adapter

Measuring

1. Start up the engine, and accelerate it to the maximum speed.
2. Warm up the hydraulic oil and devices to 50 ± 5 °C (122 ± 9 °F).
3. Press the hydraulic unlock switch.
4. Operate each control lever gradually in its full stroke.
5. Measure the pressure 3 times to calculate the average.

Service specification

Pilot secondary pressure	Front attachment control valve	3.5 MPa 36 kgf/cm ² 510 psi
	Travel control valve	2.1 MPa 21 kgf/cm ² 300 psi

4. Repairing

4.1 HST pump

4.1.1 Removing and installing the HST pump

⚠ CAUTION

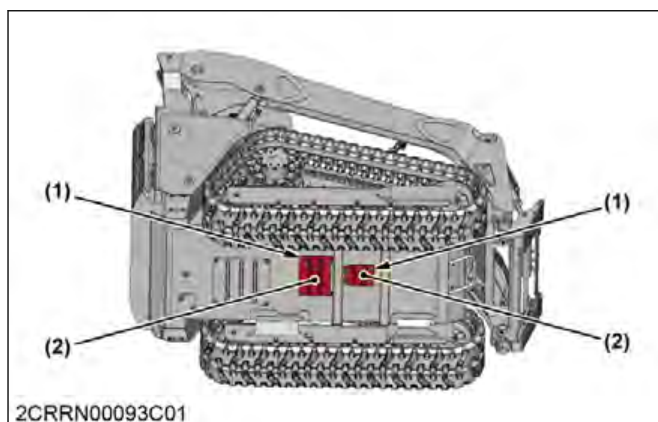
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

■ IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

- Park the machine on the firm and level ground.
- Jack up the machine.
- Lower the front attachment to the ground and stop the engine.
- Remove the step.
- Remove the 8 bolts and the 2 covers.

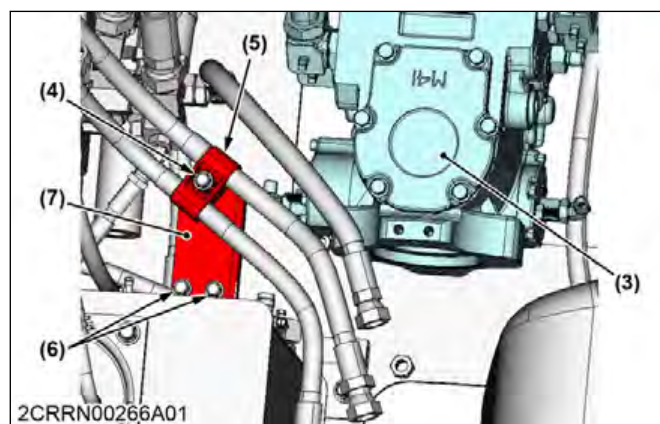


- (1) Bolt (M12 × 30) × 8 (2) Cover × 2

- Put an oil pan under the machine.
- Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
- Remove the gear pump.

Removing

- Disconnect the hydraulic hoses from the HST pump.
- Remove the bolt and the hose guide.
- Remove the 2 bolts and the stay.



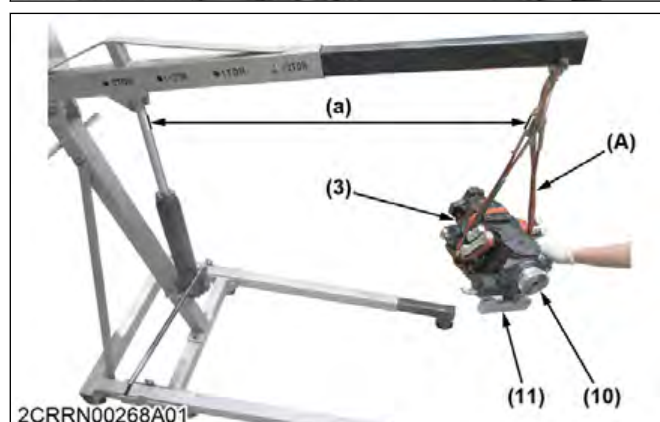
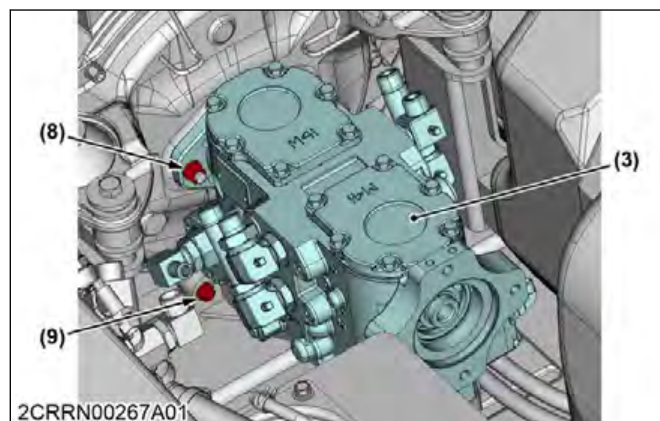
- (3) HST pump (6) Bolt (M8 × 20) × 2
(4) Bolt (M8 × 45) (7) Stay
(5) Hose guide

- Attach a nylon sling, and hoist the HST pump for support with an engine hoist.

■ NOTE

- The length of the engine hoist's arm needs to be more than approximately 1.4 m (55 in.).

- Remove the 2 nuts and the 2 bolts.
- Pull out the shaft of the HST pump together with the coupling and the bracket.

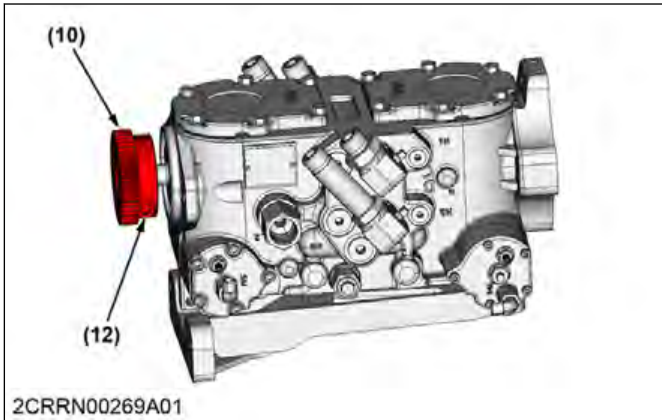


- (3) HST pump (A) Nylon sling
(8) Nut (M12) × 2 (a) Length of the engine hoist's arm
(9) Bolt (M10 × 35) × 2
(10) Coupling
(11) Bracket

Mass

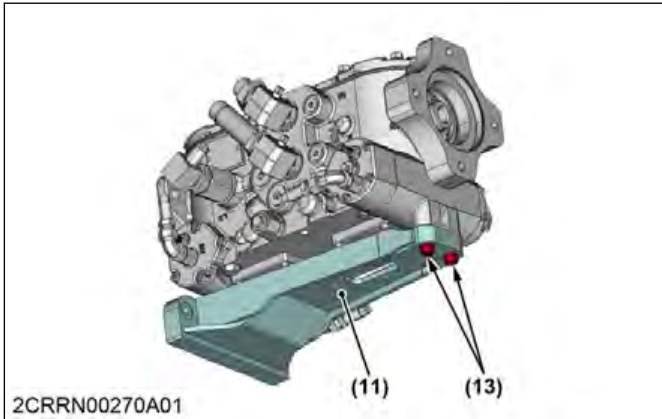
(3) HST pump (Including the coupling and the bracket)	Approximately 70 kg Approximately 154 lbs
--	--

7. Loosen the cap bolt, and remove the coupling.



(10) Coupling (12) Cap bolt (M12 × 35)

8. Remove the 2 bolts and the bracket from the HST pump.



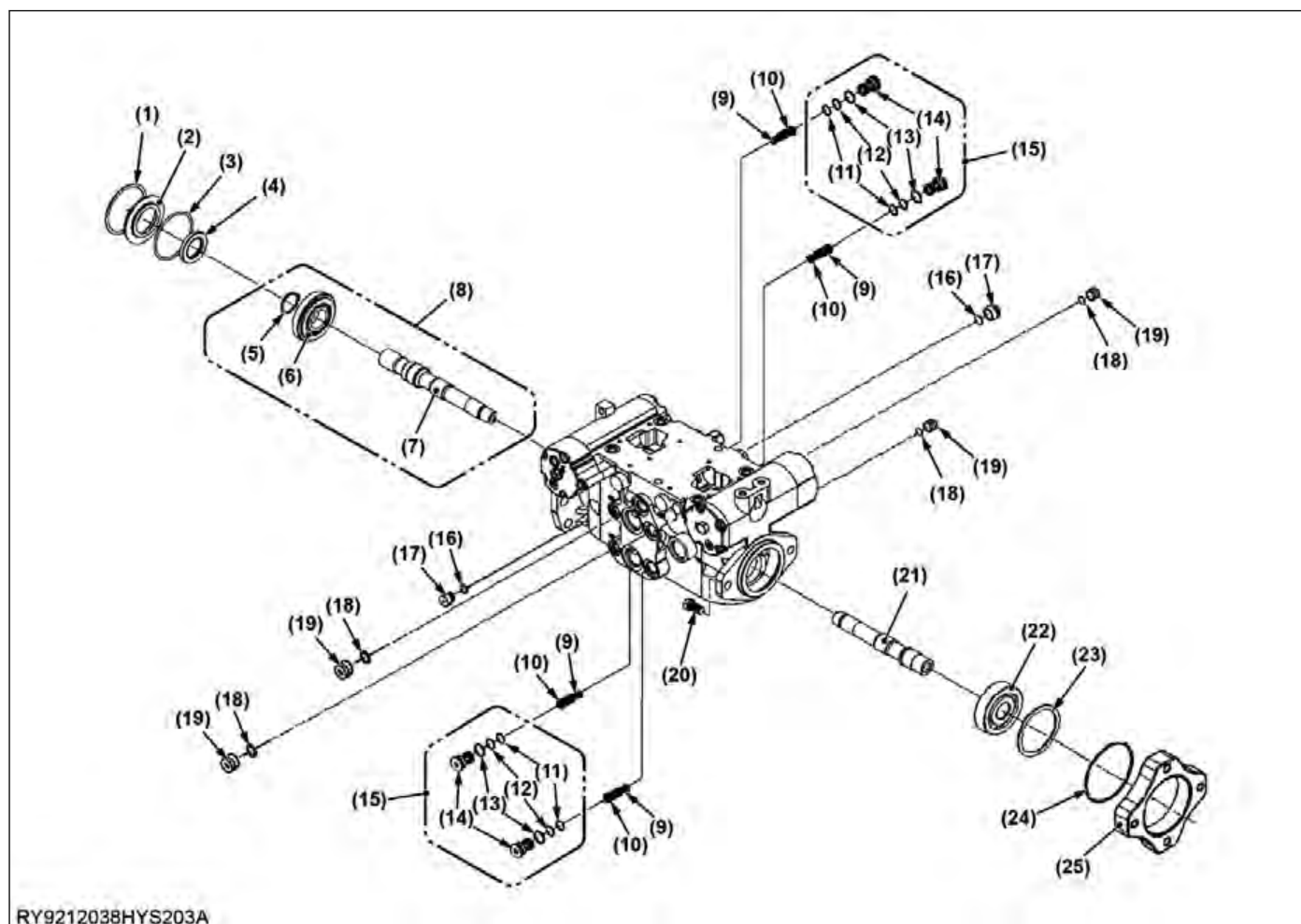
(11) Bracket (13) Bolt (M10 × 35) ×2

Installing

Tightening torque

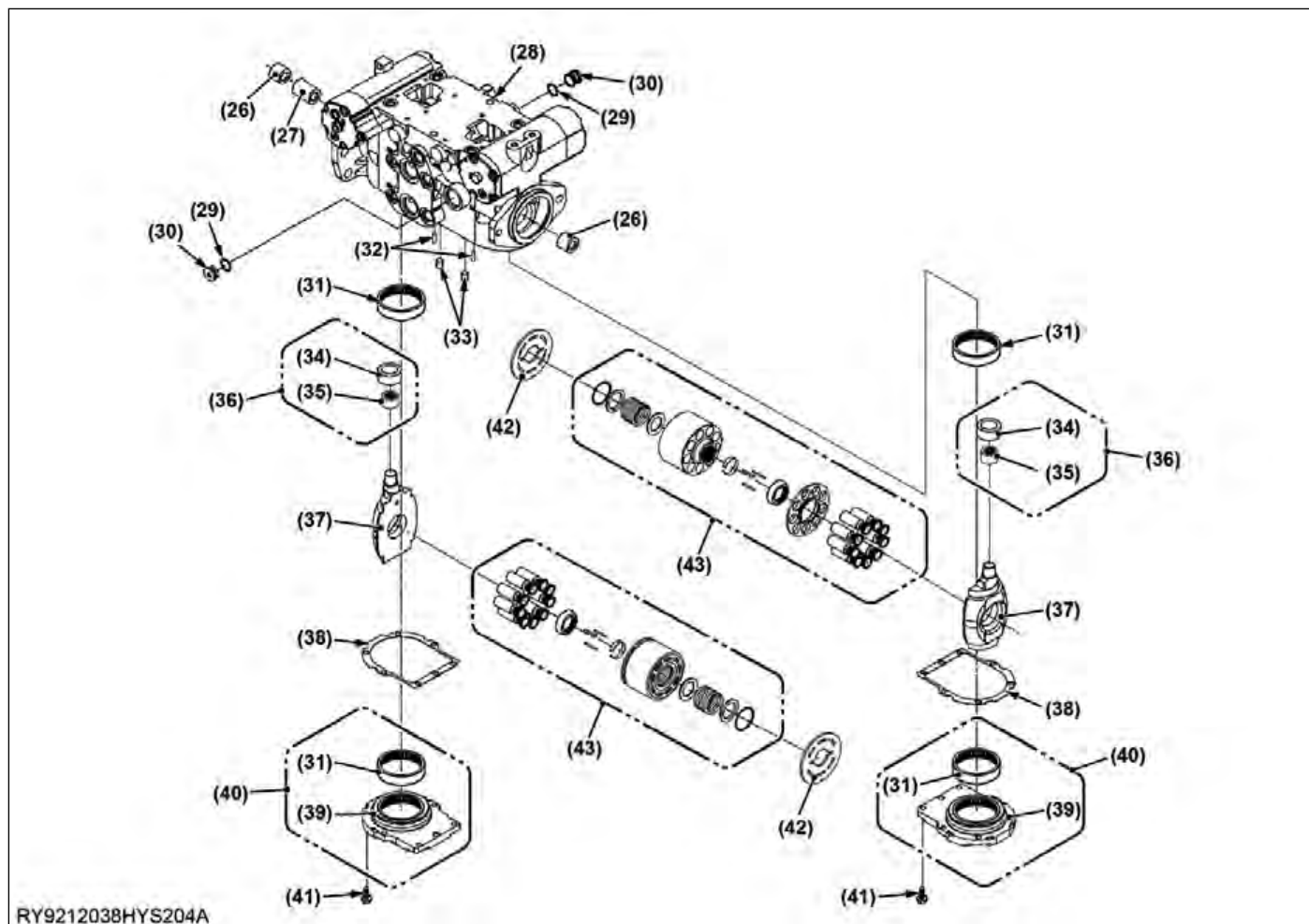
(8) Nut	77.5 to 90.2 N · m 7.9 to 9.2 kgf · m 57.2 to 66.5 lbf · ft	—
(9) Bolt	48.1 to 55.9 N · m 4.9 to 5.7 kgf · m 35.5 to 41.2 lbf · ft	Thread lock (Loctite 263)
(12) Cap bolt	77.5 to 90.2 N · m 7.9 to 9.2 kgf · m 57.2 to 66.5 lbf · ft	Thread lock (Loctite 263)

4.1.2 HST pump components



RY9212038HYS203A

- | | | | |
|------------------------|-------------------------|---|-------------------|
| (1) Ring | (8) Rear shaft assembly | (14) High pressure relief valve plug x4 | (19) Plug x4 |
| (2) Carrier shaft seal | (9) Spring x4 | (15) High pressure relief valve assembly x4 | (20) Bolt |
| (3) O-ring | (10) Adjuster x4 | (16) O-ring x2 | (21) Front shaft |
| (4) Oil seal | (11) O-ring x4 | (17) Plug x2 | (22) Ball bearing |
| (5) Snap ring | (12) Back-up ring x4 | (18) O-ring x4 | (23) Ring |
| (6) Roller bearing | (13) O-ring x4 | | (24) O-ring |
| (7) Rear shaft | | | (25) Adapter |

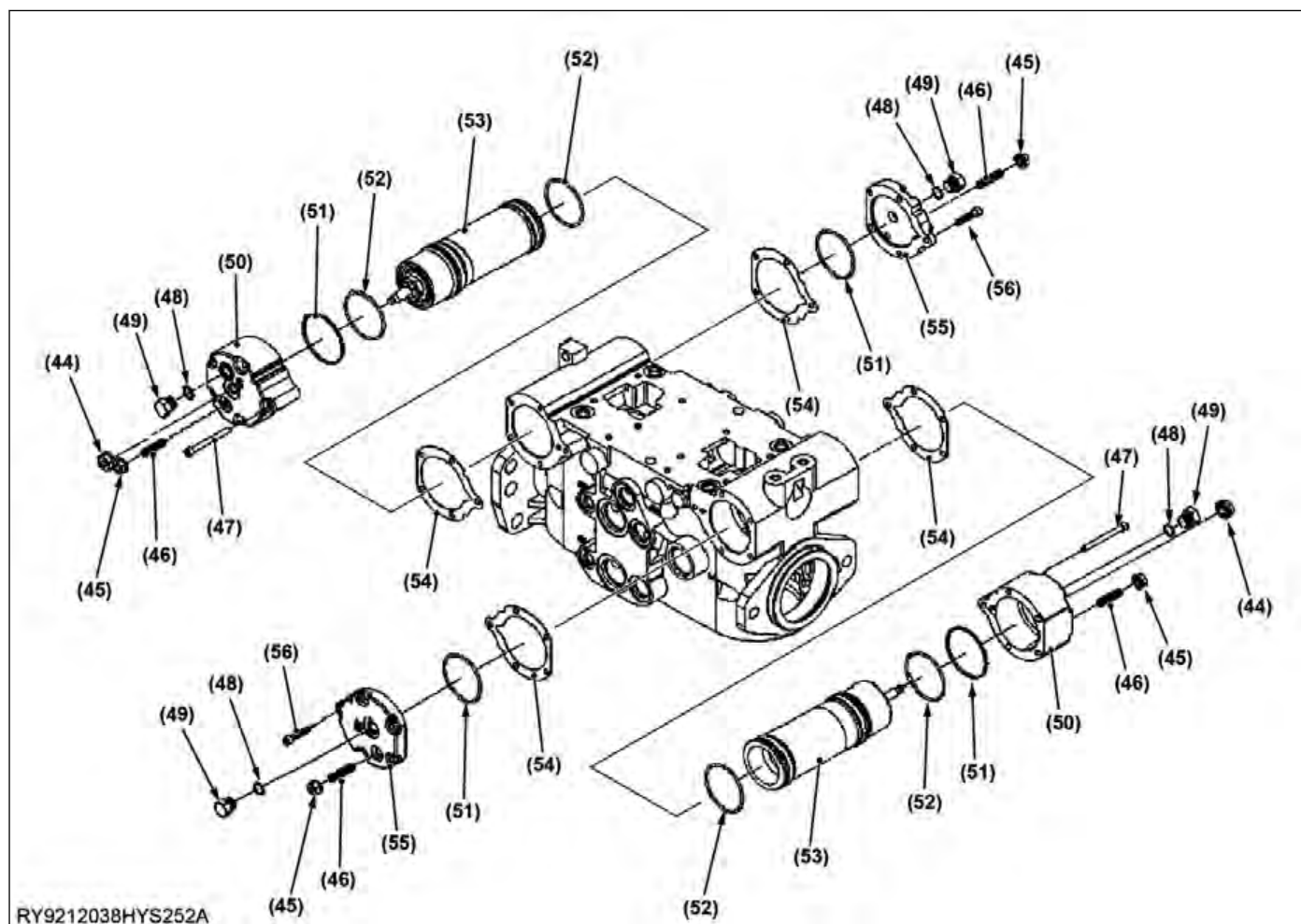


(26) Needle bearing ×2
 (27) Coupling
 (28) Housing
 (29) O-ring ×2
 (30) Plug ×2

(31) Needle bearing ×4
 (32) Pin ×2
 (33) Pin ×2
 (34) Bearing ×2
 (35) Needle bearing ×2

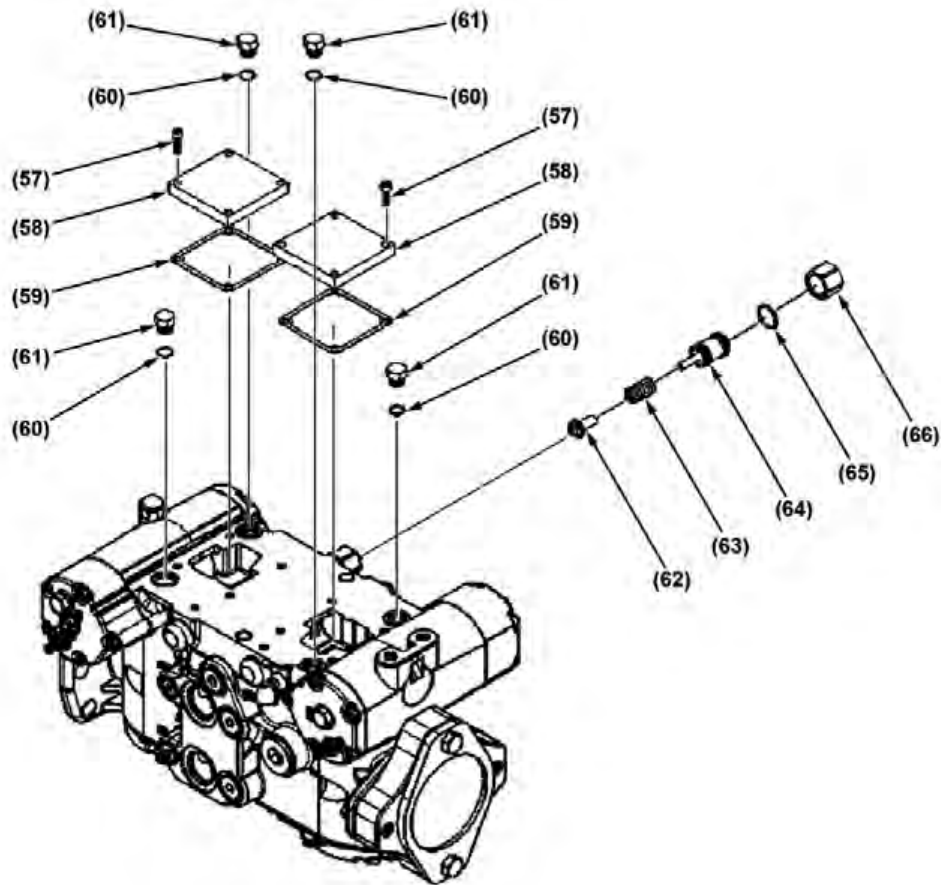
(36) Bearing assembly ×2
 (37) Swash plate ×2
 (38) Gasket ×2
 (39) Cover side ×2
 (40) Cover assembly ×2

(41) Bolt (M8 ×20) ×6
 (42) Valve plate ×2
 (43) Cylinder block kit ×2



RY9212038HYS252A

- | | | | |
|-------------------|---------------------|-------------------------|------------------|
| (44) Locknut ×2 | (48) O-ring ×4 | (52) O-ring ×2 | (56) Cap bolt ×2 |
| (45) Nut ×2 | (49) Plug ×4 | (53) Piston assembly ×2 | |
| (46) Set screw ×4 | (50) Servo cover ×2 | (54) Gasket ×2 | |
| (47) Cap bolt ×2 | (51) Piston ring ×4 | (55) Servo cover ×2 | |



2CRRN00563A01

(57) Cap bolt (M6 ×20) ×2
 (58) Cover ×2
 (59) Gasket ×2

(60) O-ring ×2
 (61) Plug ×2
 (62) Poppet

(63) Spring
 (64) Adjuster
 (65) O-ring

(66) Locknut

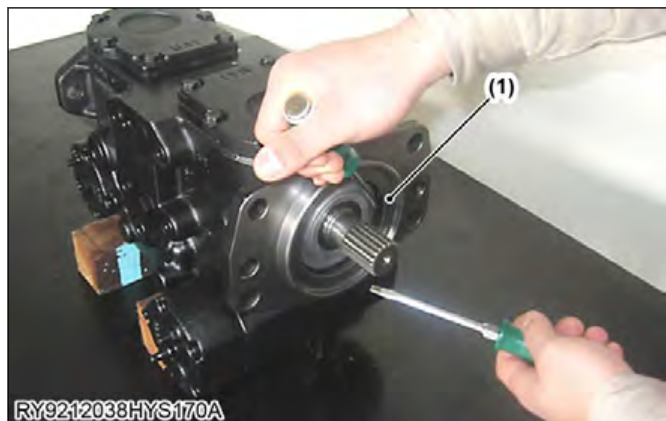
4.1.3 Disassembling the HST pump

■ IMPORTANT

- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating the surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.

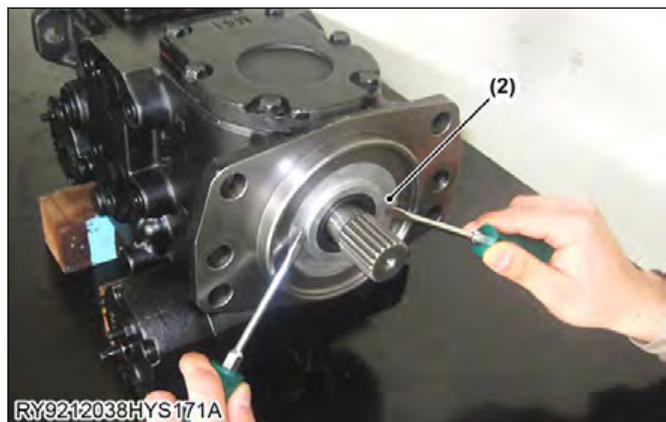
Disassembling the shaft assembly

1. Remove the ring with a flat tip screwdriver.



(1) Ring

2. Remove the carrier shaft seal with flat tip screwdrivers.



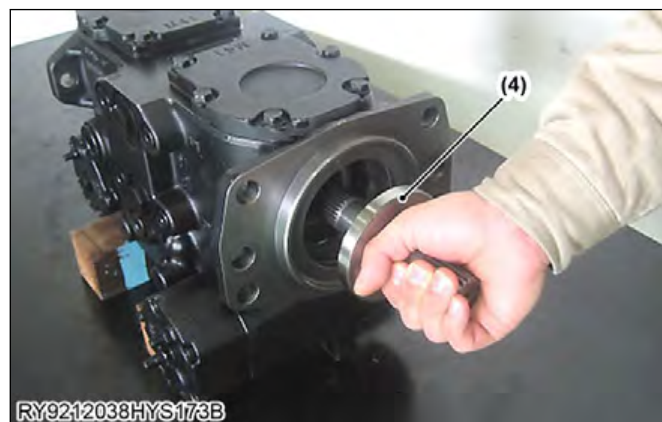
(2) Carrier shaft seal

3. Remove the O-ring.



(3) O-ring

4. Remove the rear shaft assembly.



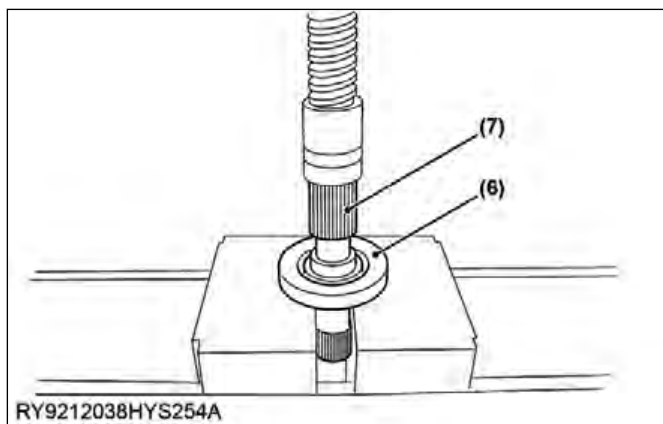
(4) Rear shaft assembly

5. Remove the snap ring from the rear shaft assembly with snap ring pliers.



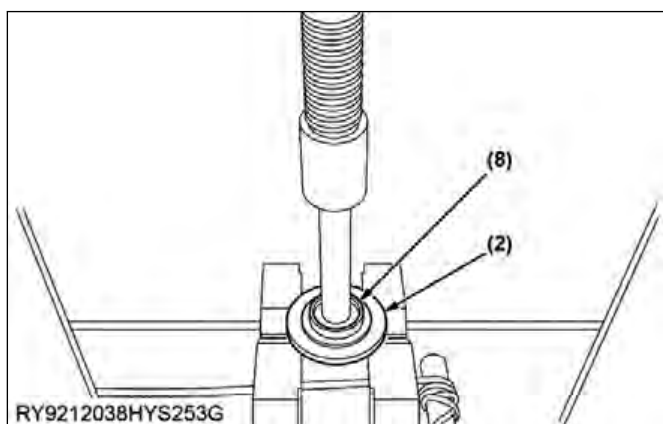
(5) Snap ring

6. Remove the roller bearing from the rear shaft with a press.



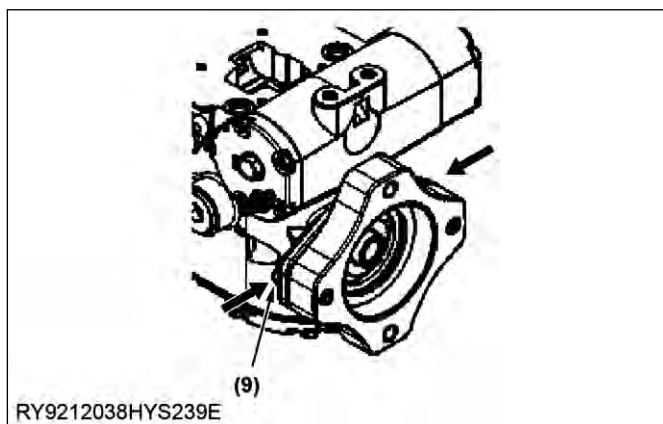
(6) Roller bearing (7) Rear shaft

7. Remove the oil seal from the carrier shaft seal with a press.



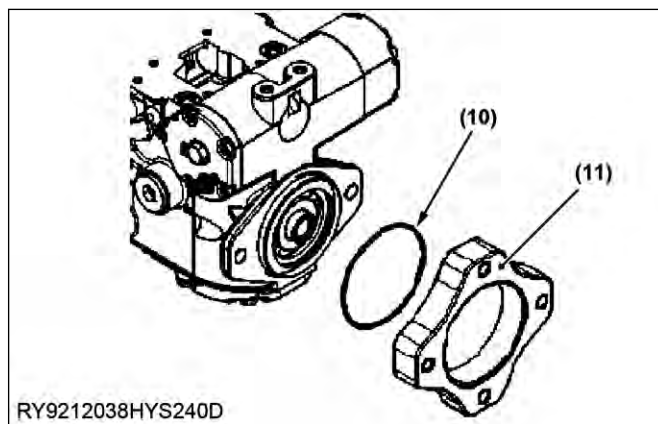
(2) Carrier shaft seal (8) Oil seal

8. Remove the 2 bolts.



(9) Bolt (M12 × 40) × 2

9. Remove the adapter and the O-ring.



(10) O-ring (11) Adapter

10. Remove the ring with flat tip screwdrivers.



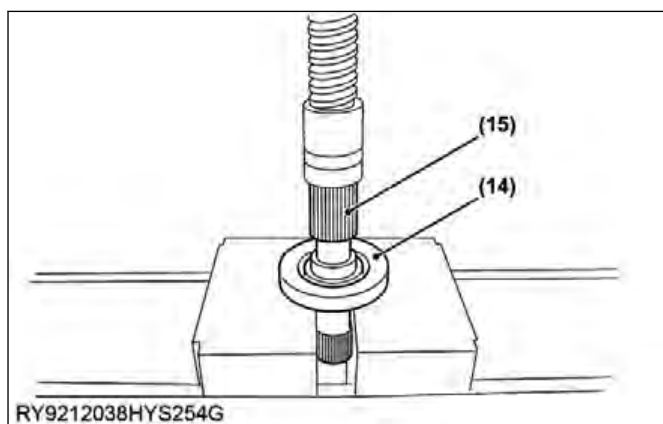
(12) Ring

11. Remove the front shaft assembly with a hammer and pin punch.



(13) Front shaft assembly

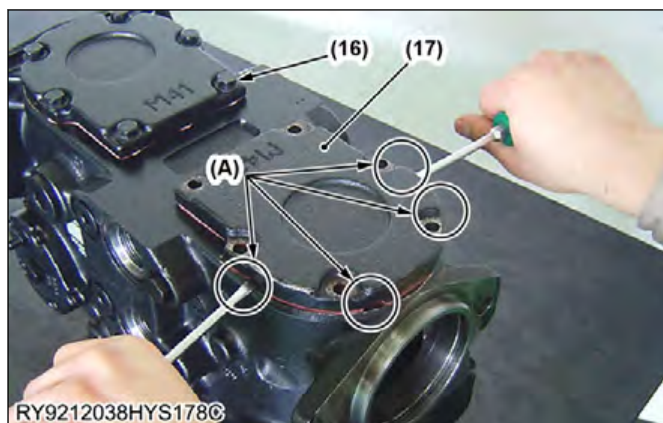
12. Remove the ball bearing from the front shaft with a press.



(14) Ball bearing (15) Front shaft

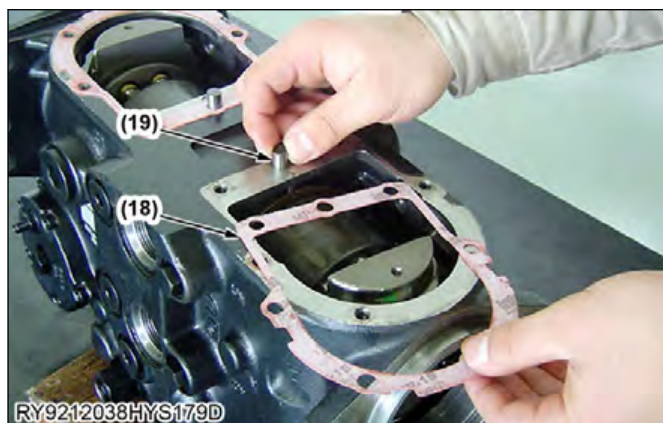
Disassembling the cylinder block

1. Remove the 6 bolts. Remove the cover assembly by inserting flat tip screwdrivers into the grooves.



(16) Bolt (M8 × 20) × 6 (A) Groove (17) Cover assembly

2. Remove the gasket and the pin.



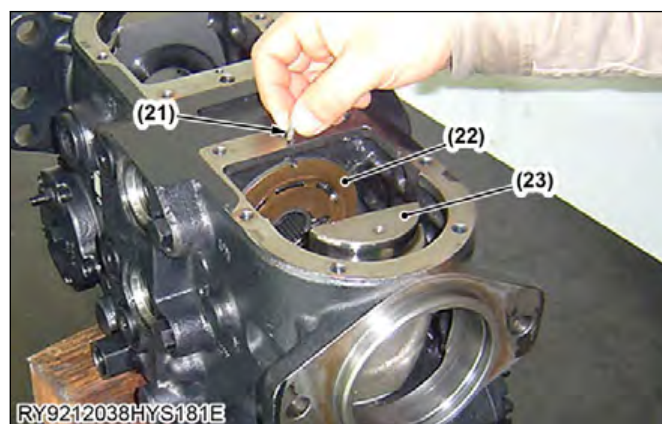
(18) Gasket (19) Pin

3. Remove the cylinder block kit.



(20) Cylinder block kit

4. Remove the pin, valve plate, and swash plate.



(21) Pin (22) Valve plate (23) Swash plate

5. Remove the needle bearing with a slide hammer.



(24) Needle bearing

6. Remove the coupling.



(25) Coupling

Disassembling the relief valve

1. Measure the set length of the adjustment screw of the charge relief valve with a depth gauge.



(26) Adjustment screw (a) Set length

2. Remove the locknut.



(27) Locknut

3. Remove the adjuster, O-ring, spring, and poppet.

(28) Adjuster
(29) O-ring
(30) Spring
(31) Poppet

4. Remove the high pressure relief valve plug, adjuster, and spring.

(32) High pressure relief valve plug
(33) Adjuster
(34) Spring**Disassembling the servo piston**

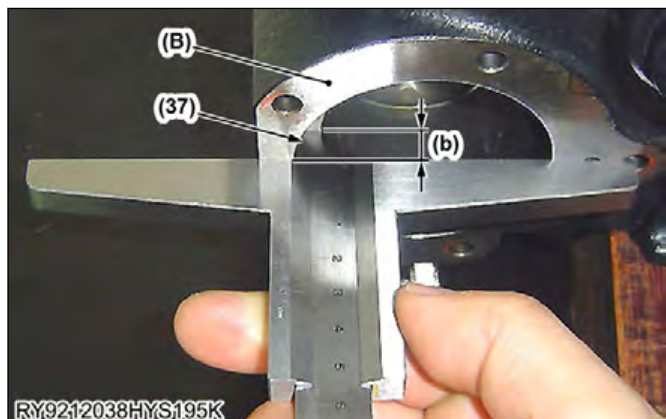
1. Remove the 5 bolts, the servo cover, and the gasket.

(35) Servo cover
(36) Gasket

2. Measure the set depth of the servo piston assembly from the mounting surface with a depth gauge.

■ NOTE

- The measured value is required when assembling.

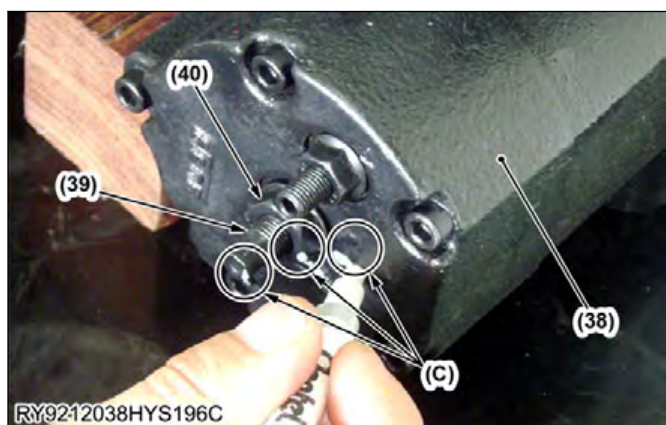


(37) Servo piston assembly (B) Mounting surface
(b) Set depth

3. Mark the position and length of the set screw and the position of the locknut on each casing.

■ NOTE

- The marks are required when assembling.

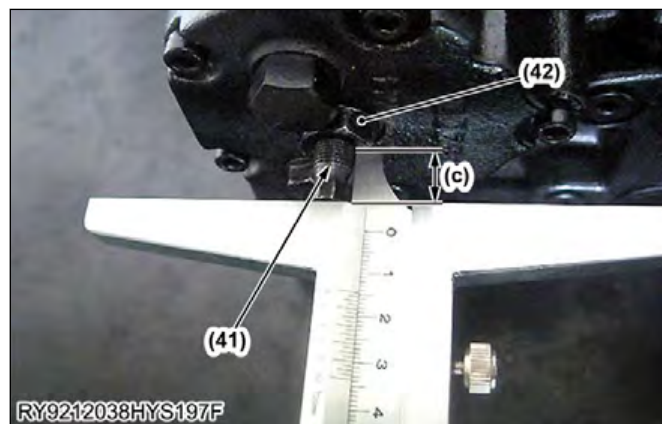


(38) Casing (C) Mark
(39) Set screw
(40) Locknut

4. Measure the set length of the set screw with a depth gauge.

■ NOTE

- The measured value is required when assembling.

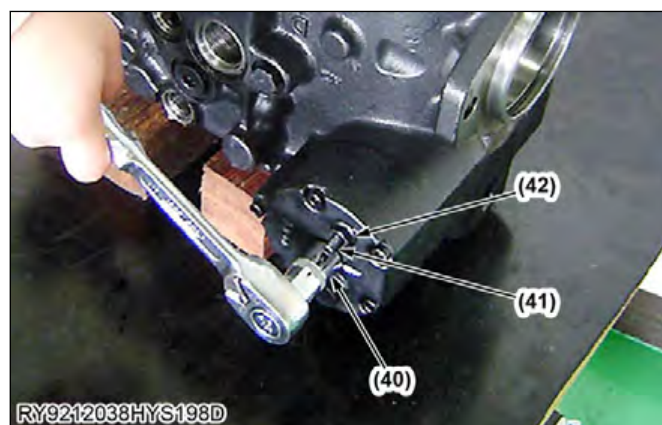


(41) Set screw (c) Set length
(42) Nut

5. Remove the locknut.

■ IMPORTANT

- Do not remove the locknut except when adjusting the length of the set screw. If the length of the set screw is adjusted, the neutral position of the swash plate will be changed.



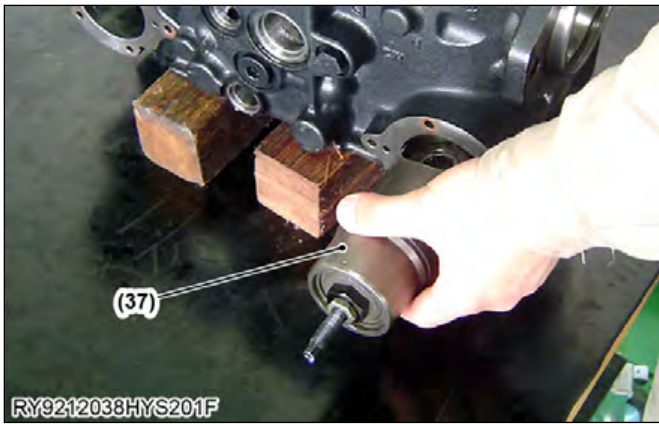
(40) Locknut (42) Nut
(41) Set screw

6. Remove the 5 bolts, the servo cover, and the gasket.



(43) Servo cover (44) Gasket

7. Remove the servo piston assembly.



(37) Servo piston assembly

8. Remove the bearing assembly.



(45) Bearing assembly

9. Remove the 2 piston rings.

■ NOTE

- Cut the 2 piston rings with a hammer and a flat tip screwdriver.



(46) Piston ring

10. Remove the O-ring with a flat tip screwdriver.



(47) O-ring

4.1.4 Assembling the HST pump

■ IMPORTANT

- Do not reuse removed O-rings, oil seals or the like for assembly to avoid oil leakage.
- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Apply lubricant or grease to every seal to avoid damage when assembling.
- After assembly, clean the outside of hydraulic component.
- To prevent seizure and cavitation after assembling, fully fill the hydraulic oil from the lubrication port.
- When performing measurement, adjustment, or repairs, set up the meter panel if necessary.
 - Service dealer mode: No.05 HST start-up point settings

Assembling the servo piston

1. Install the O-ring to the servo piston.

■ NOTE

- Apply hydraulic oil to the O-ring.



(1) Servo piston (2) O-ring

2. Install the piston ring onto the O-ring at the top side of the servo piston only.

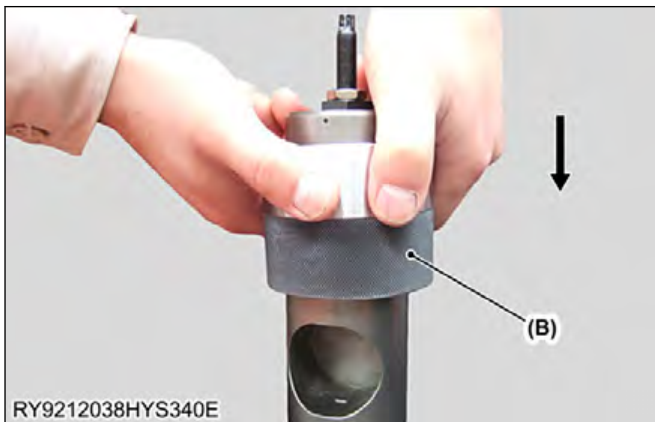
■ NOTE

- Apply hydraulic oil to the piston ring.

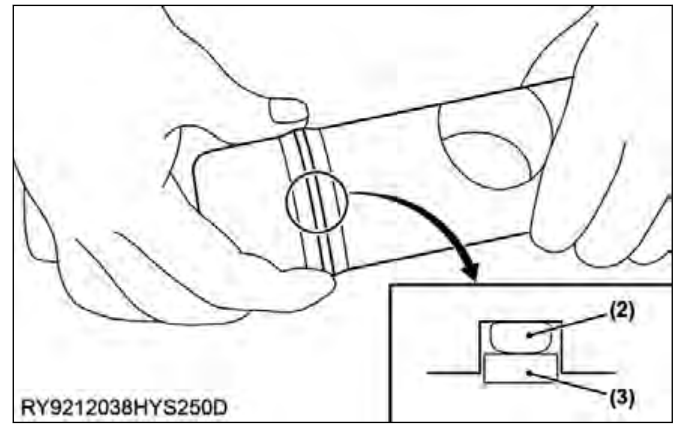


(1) Servo piston (A) Top side of the servo piston (3) Piston ring

3. Correct the piston ring outer diameter with the piston ring correction jig.



RY9212038HYS340E



(2) O-ring (3) Piston ring (B) Piston ring correction jig

4. Install the bearing assembly.

■ NOTE

- Make the mark face up.

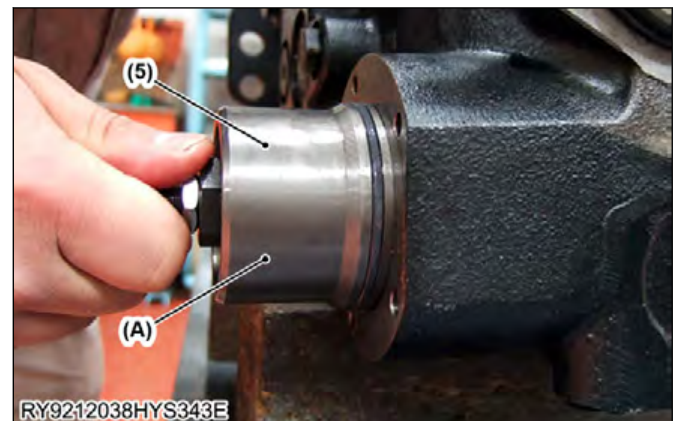


(4) Bearing assembly

5. Install the servo piston assembly.

■ NOTE

- Apply hydraulic oil to the servo piston assembly.
- Do not use a hammer. It may damage the piston ring.



(5) Servo piston assembly (A) Top side of the servo piston

6. Adjust the set length of the servo piston assembly by measuring at the bottom side of the servo piston with a depth gauge.

■ NOTE

- Keep the set depth under 13 mm (0.51 in.) to protect the piston ring from damage.



(a) Set length (C) Bottom side of the servo piston

7. Install the piston ring to the bottom side of the servo piston.

■ NOTE

- Apply hydraulic oil to the piston ring.

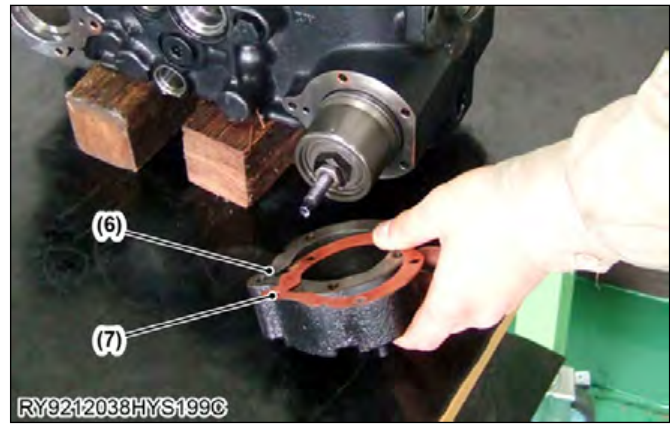


(3) Piston ring (C) Bottom side of the servo piston

8. Install the gasket and the servo cover.

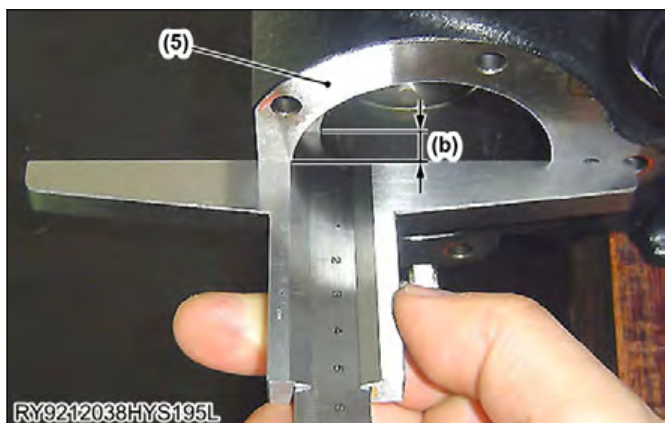
■ NOTE

- Grease the gasket.
- Turn the servo cover right, and install it firmly.



(6) Servo cover (7) Gasket

9. Adjust the set depth of the servo piston assembly as measured before with a depth gauge.



(5) Servo piston assembly (b) Set depth

10. Install the 5 bolts onto the top side of the servo cover evenly.

NOTE

- Install the 5 bolts (M6 × 30) onto the bottom side of the servo cover as well.



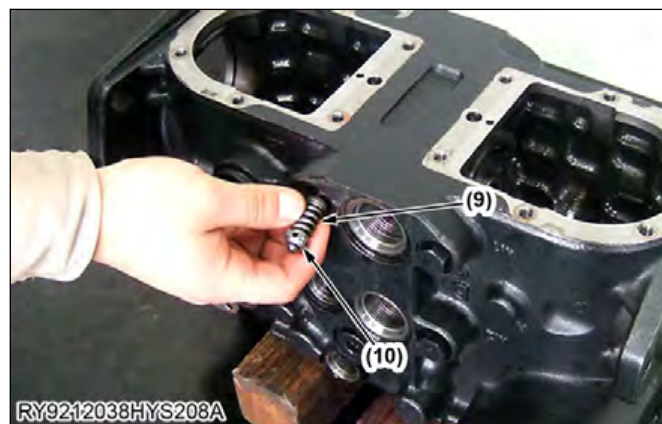
(8) Bolt (M6 × 60) × 5

Tightening torque

(8) Bolt	15.0 to 18.0 N · m 1.53 to 1.84 kgf · m 11.1 to 13.3 lbf · ft	—
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Assembling the relief valve

1. Install the spring and the adjuster.



(9) Spring (10) Adjuster

2. Install the high pressure relief valve plug.

NOTE

- Grease the 2 O-rings and the back-up ring.
- Install the 2 O-rings and the back-up ring onto the high pressure relief valve plug.



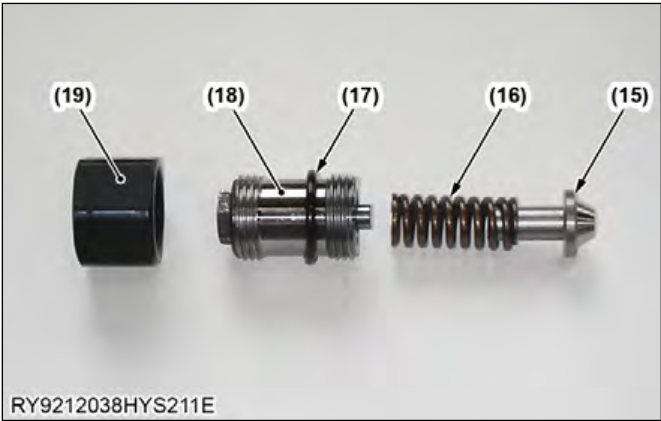
(11) O-ring (12) Back-up ring (13) O-ring (14) High pressure relief valve plug

Tightening torque

(14) High pressure relief valve plug	68.0 to 95.0 N · m 6.93 to 9.69 kgf · m 50.2 to 70.1 lbf · ft	—
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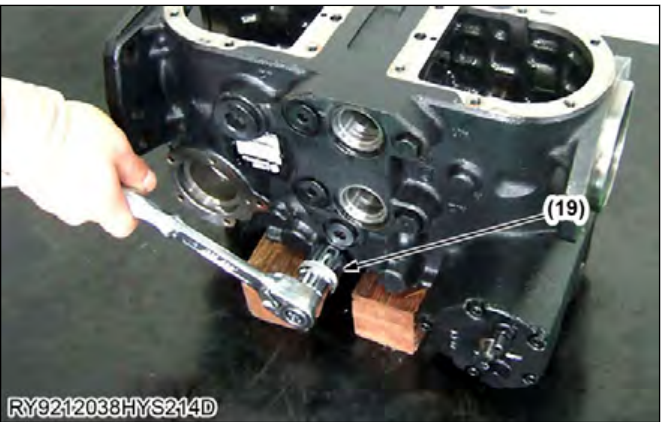
3. Install the poppet, spring, and adjuster in order.

- NOTE
- Install the O-ring onto the adjuster.



- (15) Poppet
(16) Spring
(17) O-ring
(18) Adjuster
(19) Locknut

4. Install the locknut, and adjust the set length of the charge relief valve as measured before with a depth gauge.



(19) Locknut (c) Set length

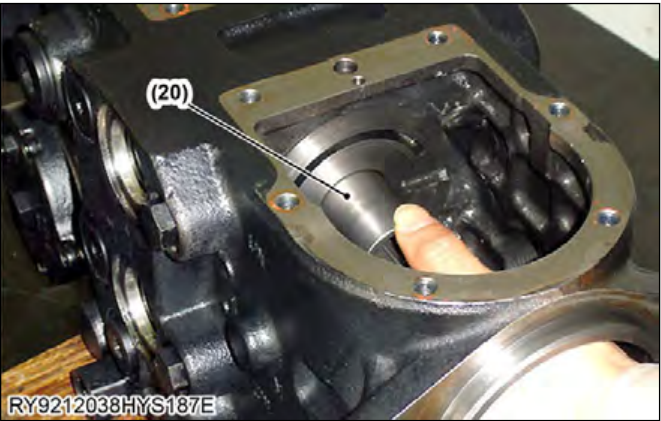
Tightening torque

(19) Locknut	54.0 to 136.0 N · m 5.51 to 13.87 kgf · m 39.8 to 100.3 lbf · ft	—
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5. Measure the set length with a depth gauge again.

Assembling the cylinder block

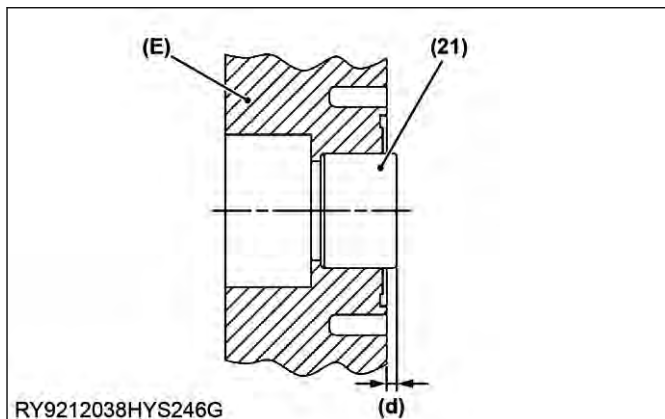
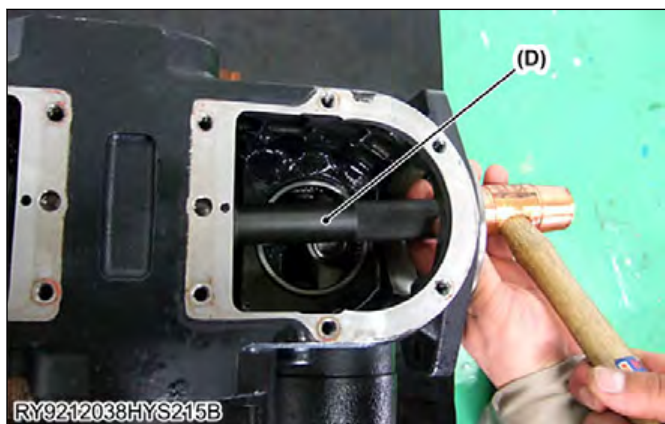
1. Install the coupling.



(20) Coupling

2. Install the needle bearing with a hammer and the needle bearing installation jig.

- NOTE
- Measure the set length between the needle bearing and the body with a depth gauge.
 - The set length should be 2.60 ± 0.25 mm (0.10 ± 0.0098 in.).



- (21) Needle bearing
(d) Set length
(D) Needle bearing installation jig

3. Install the valve plate and the pin.

NOTE

- Hoist the HST pump to place it vertically.
- Check that the needle bearing is installed below the valve plate.
- Grease the back of the valve plate.
- Make sure that the valve plate faces the right direction.

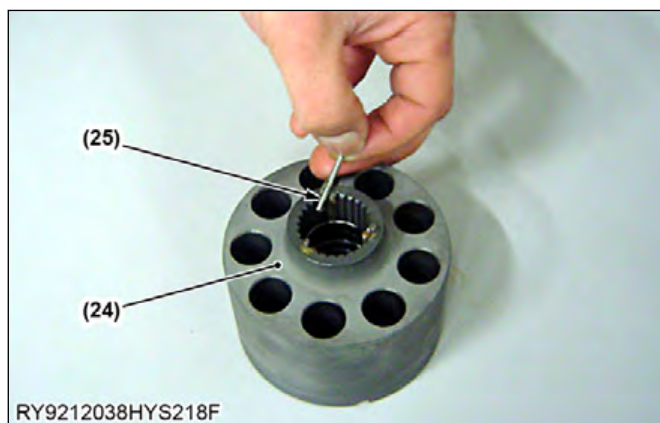


- (22) Valve plate
(23) Pin

4. Install the 3 pins into the cylinder block.

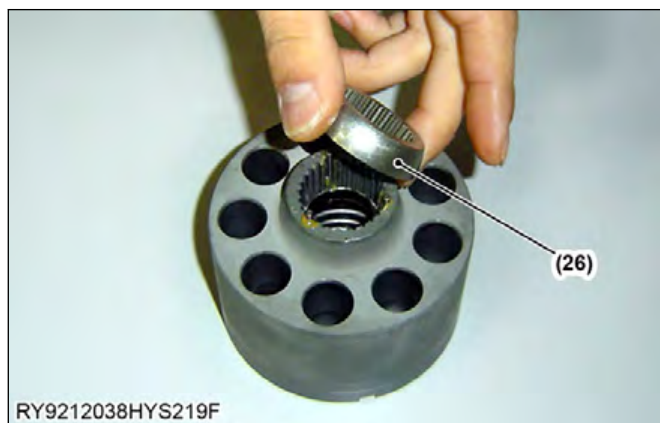
NOTE

- Grease the pins.



- (24) Cylinder block
(25) Pin

5. Install the retainer holder onto the cylinder block.



- (26) Retainer holder

6. Install the 9 pistons and retainer plate into the cylinder block.

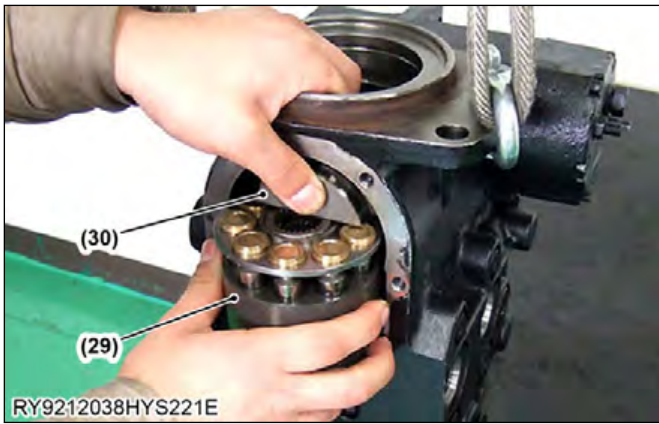
NOTE

- Apply hydraulic oil to the pistons.
- Make sure that the retainer plate faces the right direction.



- (24) Cylinder block
(27) Piston ×9
(28) Retainer plate

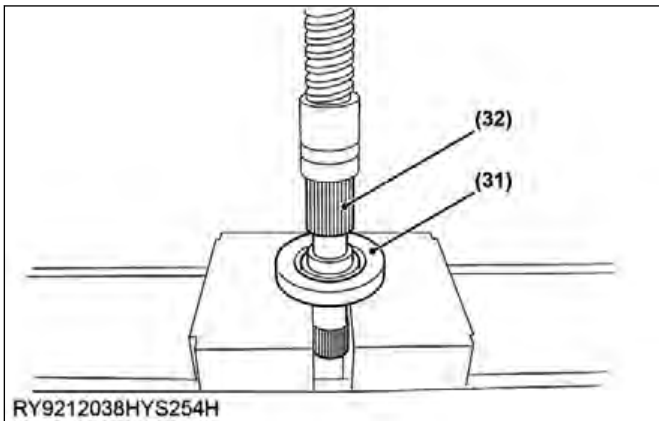
7. Install the swash plate and cylinder block kit.



(29) Cylinder block kit (30) Swash plate

Assembling the shaft assembly

1. Install the ball bearing into the front shaft with a press.



(31) Ball bearing (32) Front shaft

2. Install the front shaft assembly.



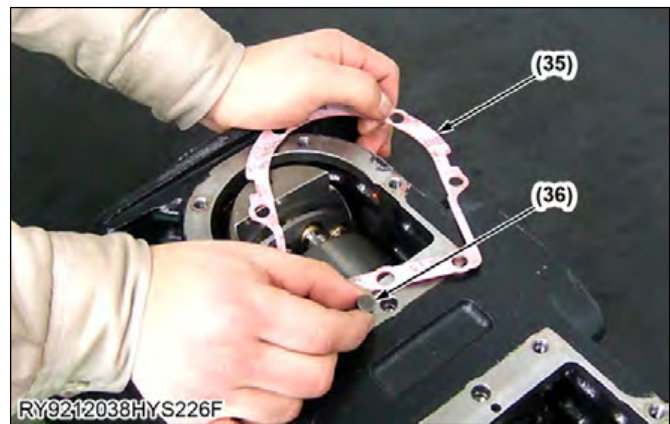
(33) Front shaft assembly

3. Install the ring.



(34) Ring

4. Install the gaskets and the pins to the rear side and the front side of the HST pump.



(35) Gasket (36) Pin

5. Install the cover assemblies to the rear side and the front side of the HST pump with a hammer.

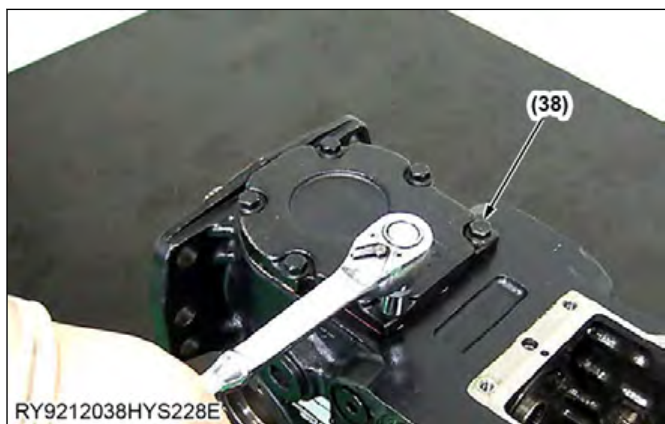


(37) Cover assembly

6. Install the 6 bolts to both rear side and the front side of the HST pump.

NOTE

- When tightening the bolts, start from the one near the pin, and tighten them evenly in a diagonal order.

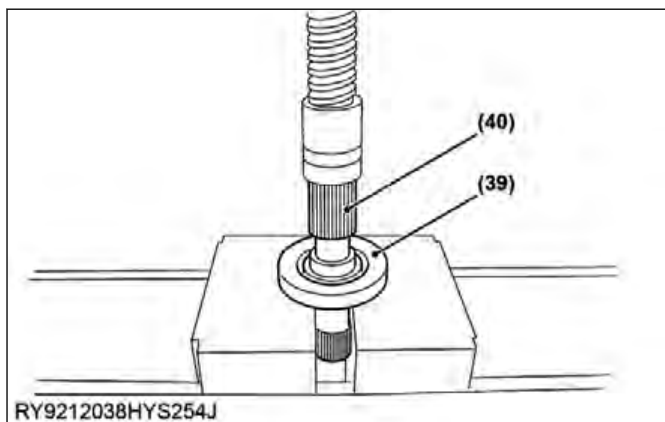


(38) Bolt (M8 × 20) ×6

Tightening torque

(38) Bolt	35.0 to 43.0 N · m 3.57 to 4.38 kgf · m 25.8 to 31.7 lbf · ft	Scotch-Grip 2353
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7. Install the roller bearing into the rear shaft with a press.

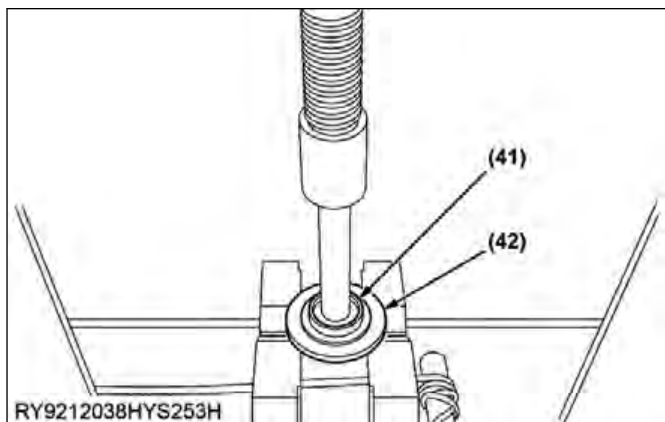


(39) Roller bearing (40) Rear shaft

8. Install the oil seal into the carrier shaft seal.

NOTE

- Grease the outside of the oil seal.
- Be careful that the oil seal is installed in the right direction.



(41) Oil seal (42) Carrier shaft seal

9. Install the snap ring into the rear shaft assembly with snap ring pliers.



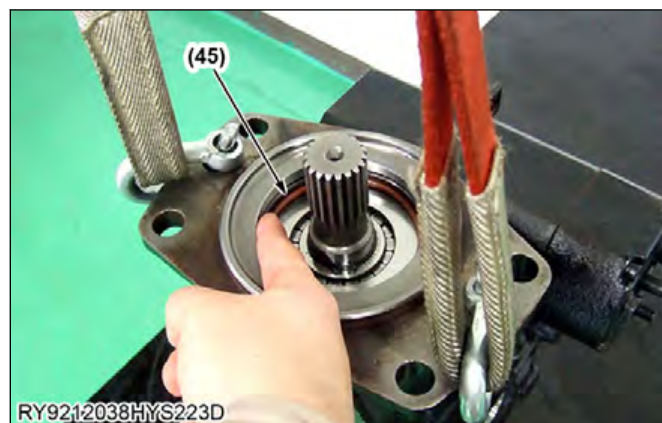
(43) Snap ring (44) Rear shaft assembly

10. Install the rear shaft assembly.



(44) Rear shaft assembly

11. Install the O-ring.



(45) O-ring

12. Install the carrier shaft seal with a hammer and a large socket.

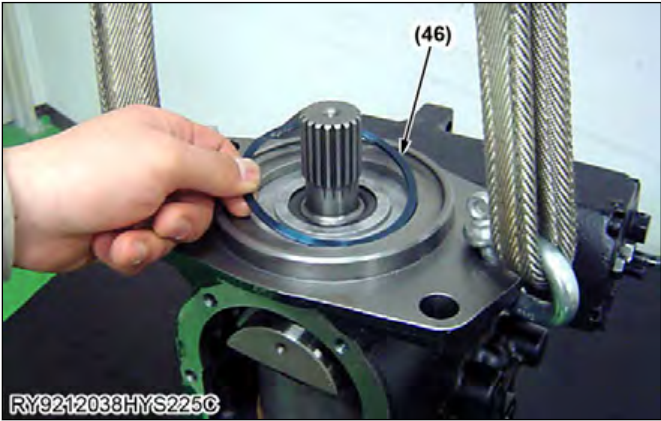
NOTE

- Grease the inside of the carrier shaft seal.
- Be careful that the carrier shaft seal is installed in the right direction.



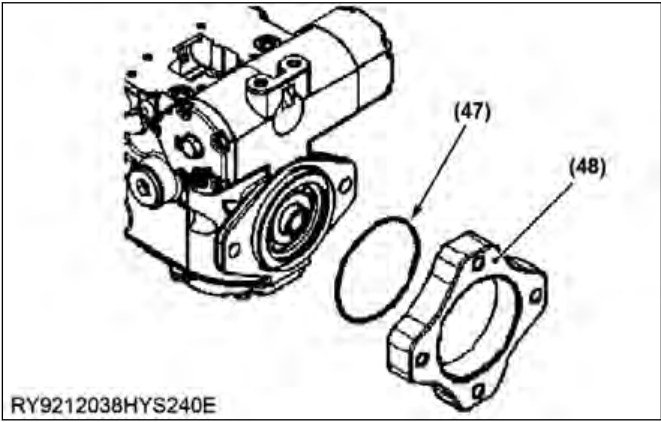
(42) Carrier shaft seal

13. Install the ring.



(46) Ring

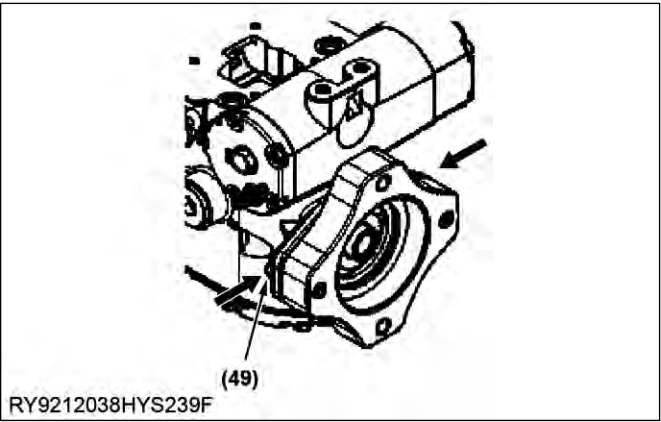
14. Install the O-ring and the adapter.



(47) O-ring

(48) Adapter

15. Tighten the 2 bolts.

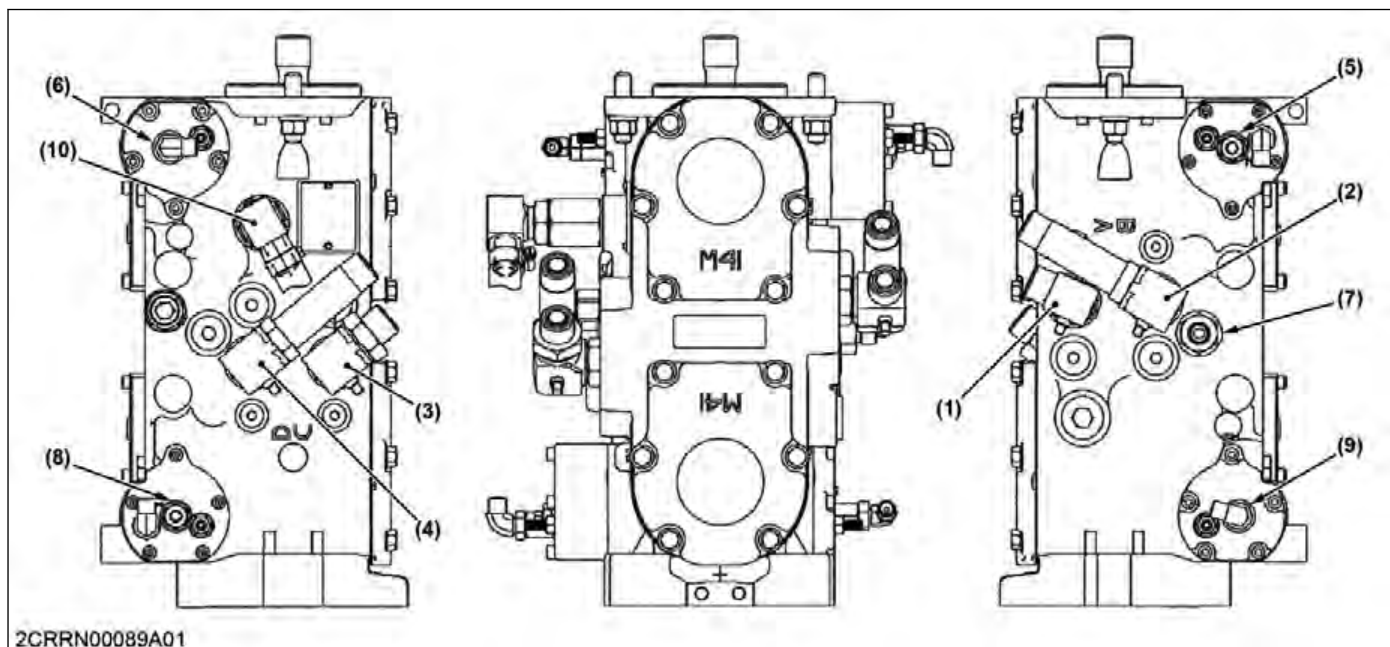


(49) Bolt (M12 × 40) ×2

Tightening torque

(49) Bolt	91.0 to 111.0 N · m 9.28 to 11.32 kgf · m 67.1 to 81.9 lbf · ft	—
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4.1.5 Installing adapters for the HST pump



No.	Port	Adapter size	Adapter angles
(1)	A	1-1/16-12UN - 1-14UN	65°
(2)	B	1-1/16-12UN - 1-14UN	60°
(3)	C	1-1/16-12UN - 1-14UN	50°
(4)	D	1-1/16-12UN - 1-14UN	50°
(5)	M4	9/16-18UNF - G1/4	—
(6)	M5	9/16-18UNF - G1/4	—
(7)	M6	7/8-14UNF - G3/8	—
(8)	M14	9/16-18UNF - G1/4	—
(9)	M15	9/16-18UNF - G1/4	75°
(10)	L2	1-1/16-12UN - ϕ 16 mm (ϕ 0.63 in.)	30°

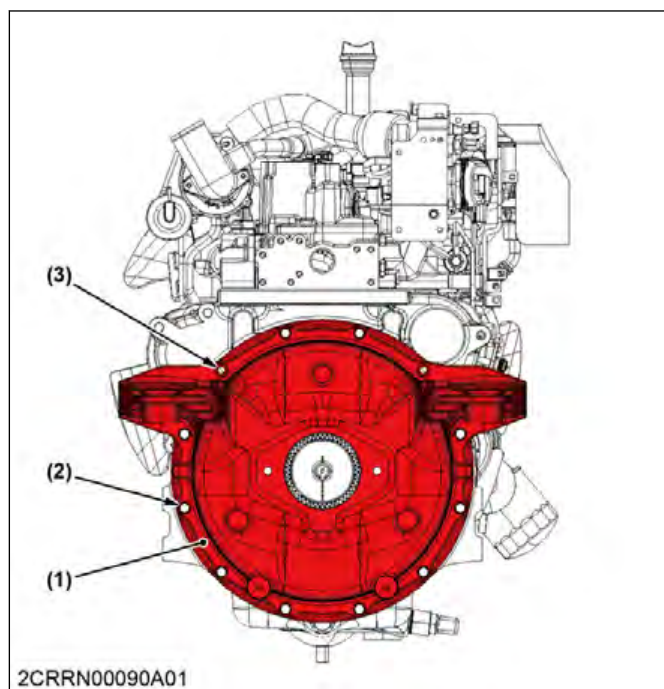
4.1.6 Removing and installing the pump coupling

Preparing

1. Drain the coolant.
2. Remove the radiator.
3. Install a vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.
4. Remove the HST pump and gear pump.
5. Remove the engine.

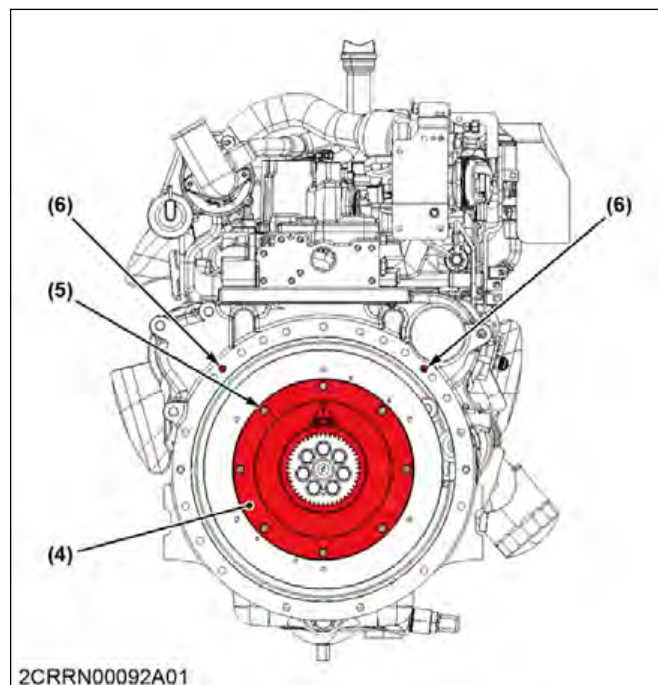
Removing

1. Remove the 10 bolts and the 2 nuts, and remove the pump housing.



- (1) Pump housing (3) Nut × 2
(2) Bolt (M10 × 25) × 10

2. Remove the 8 bolts to remove the pump coupling disc. Remove the 2 stud bolts.



- (4) Pump coupling disc (6) Stud bolt × 2
(5) Bolt (M8 × 25) × 8

Installing

■ IMPORTANT

- Grease the spline of the pump coupling.

Tightening torque

(2) Bolt (3) Nut	48.1 to 55.9 N · m 4.90 to 5.70 kgf · m 35.5 to 41.2 lbf · ft	—
(5) Bolt	23.5 to 27.5 N · m 2.40 to 2.80 kgf · m 17.3 to 20.3 lbf · ft	Thread lock (Loctite 263)
(6) Stud bolt	24.1 to 28.0 N · m 2.46 to 2.86 kgf · m 17.8 to 20.7 lbf · ft	—

4.2 Gear pump

4.2.1 Removing and installing the gear pump



CAUTION

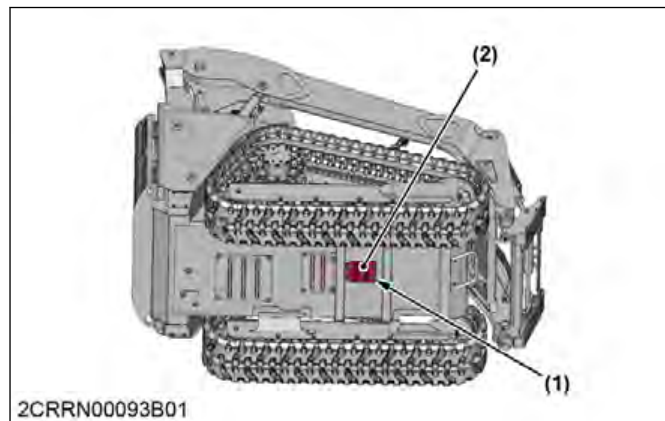
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.
- Before disconnecting the hydraulic hoses, release the residual pressure first.

■ IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Jack up the machine.
3. Lower the front attachment to the ground and stop the engine.
4. Tilt up the cab.
5. Remove the 4 bolts and the cover.



(1) Bolt (M12 × 30) ×4 (2) Cover

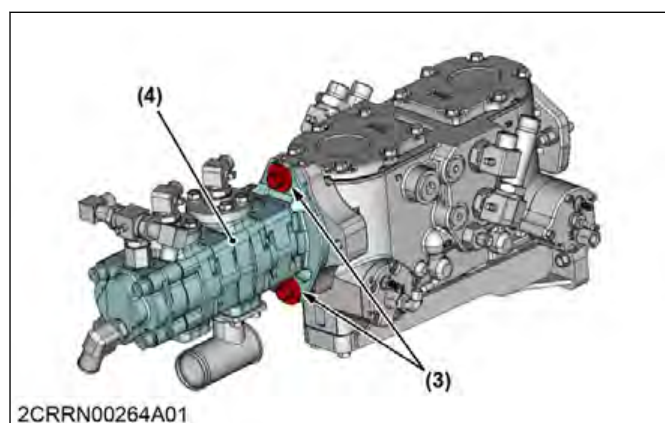
6. Put an oil pan under the machine.
7. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.

Removing

1. Disconnect the hydraulic hoses from the gear pump.
2. Remove the 2 bolts, and pull out the gear pump by hand.

NOTE

- After removing the gear pump, attach a cover or clean clothes to the HST pump to prevent oil leakage.



(3) Bolt (M12 × 40) ×2 (4) Gear pump

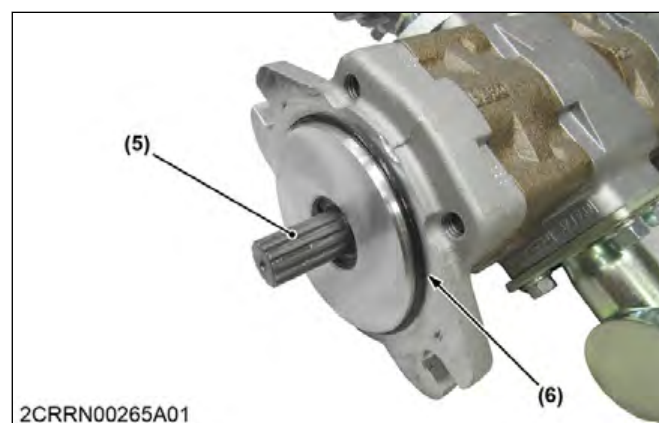
Mass

(4) Gear pump (normal flow)	Approximately 7 kg Approximately 15 lbs	Reference value
(4) Gear pump (high-flow)	Approximately 14 kg Approximately 31 lbs	Actual measured value

Installing

NOTE

- Grease the spline of the gear pump.
- Do not damage the O-ring when installing the gear pump to the HST pump.

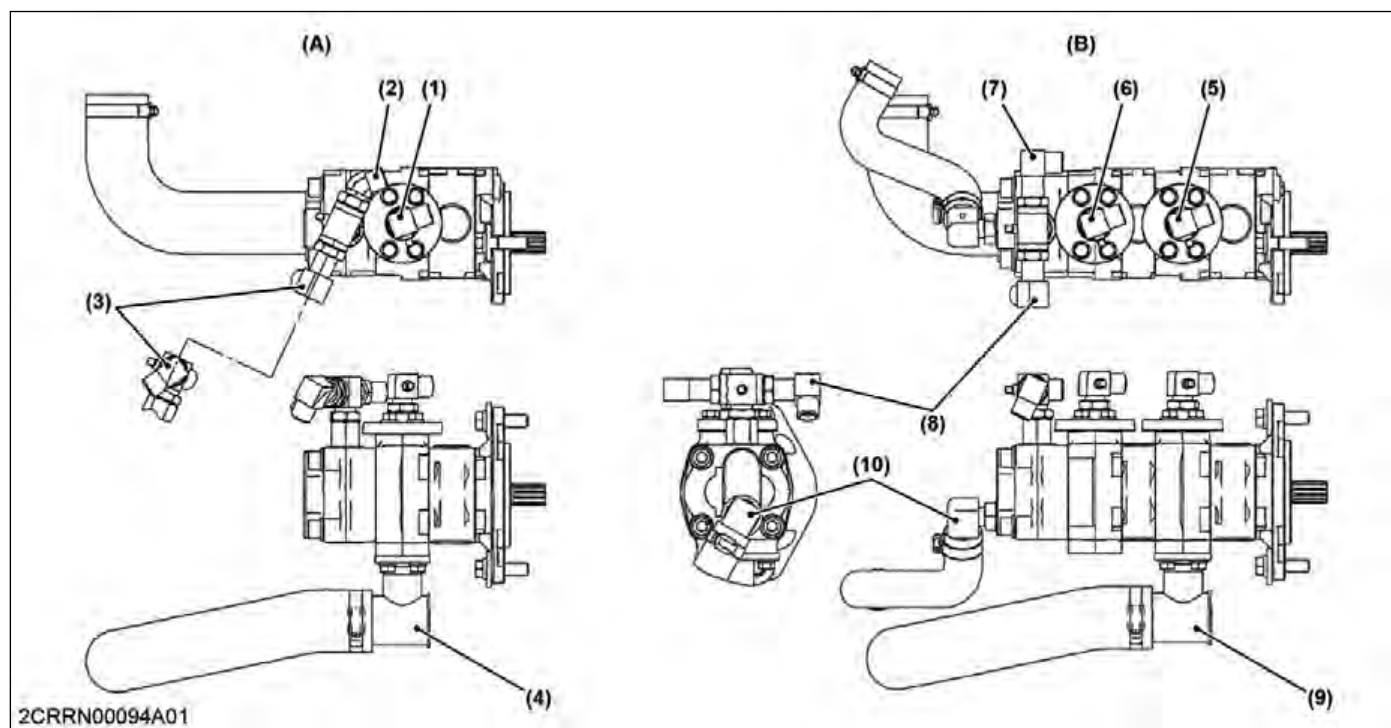


(5) Spline (6) O-ring

Tightening torque

(3) Bolt	77.5 to 90.2 N · m 7.9 to 9.2 kgf · m 57.2 to 66.5 lbf · ft	—
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4.2.2 Installing adapters for the gear pump



(A) Normal flow specification

(B) High-flow specification

Normal flow specification

No.	Port	Adapter size	Adapter angles
(1)	Main pump	G1/2-G1/2	20°
(2)	Charge pump (To HST filter)	G1/2-G1/2	60°
(3)	Charge pump (To hydraulic oil tank)	G1/2-G1/2	60°
(4)	Suction	φ50.2 mm (φ1.98 in.)	—

High-flow specification

No.	Port	Adapter size	Adapter angles
(5)	Main pump	G1/2-G1/2	20°
(6)	High flow pump	G1/2-G1/2	20°
(7)	Charge pump (To HST filter)	G1/2-G1/2	—
(8)	Charge pump (To hydraulic oil tank)	G1/2-G1/2	25°
(9)	Suction (Main pump side)	φ50.2 mm (φ1.98 in.)	—
(10)	Suction (Charge pump side)	G1/2-φ26.5 mm (φ1.04 in.)	30°

4.3 Control valve

4.3.1 Removing and installing the control valve



CAUTION

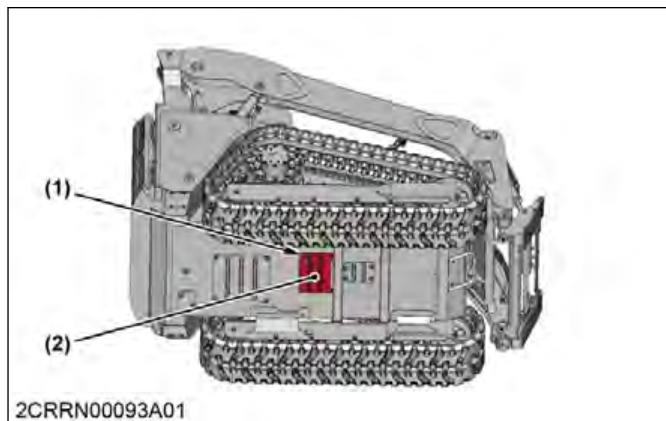
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

■ IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Jack up the machine.
3. Lower the front attachment to the ground and stop the engine.
4. Remove the cab.
5. Remove the step.
6. Remove the 4 bolts and the cover.



- (1) Bolt (M12 × 30) ×4 (2) Cover

7. Put an oil pan under the machine.
8. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.

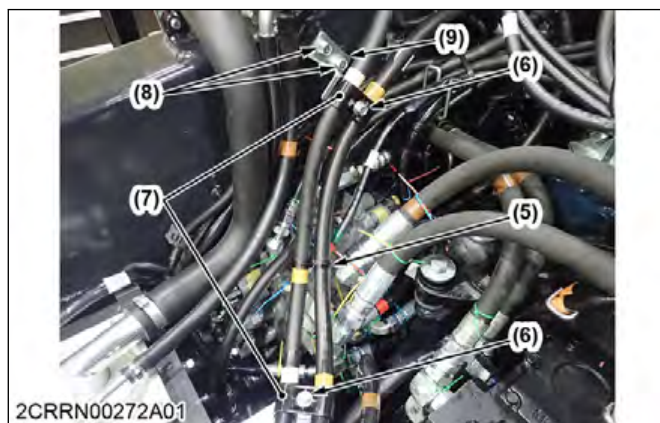
Removing

1. Disconnect the hydraulic hoses and wire harness from the control valve.
2. Remove the bolt, and put the breather filter away.



- (3) Bolt (M10 × 25) (4) Breather filter

3. Remove the hose clip.
4. Remove the 2 bolts and the 2 hose clamps.
5. Remove the 2 bolts and the stay.



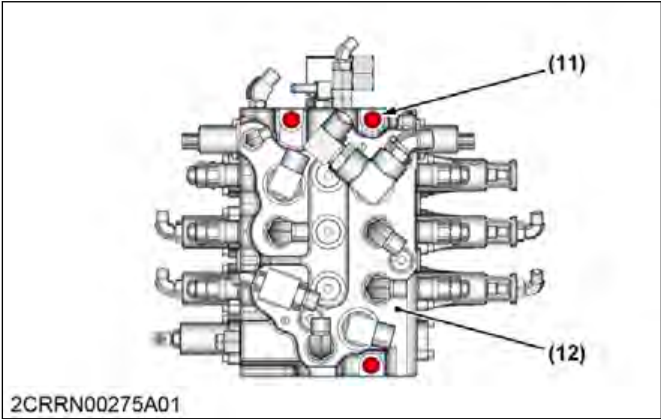
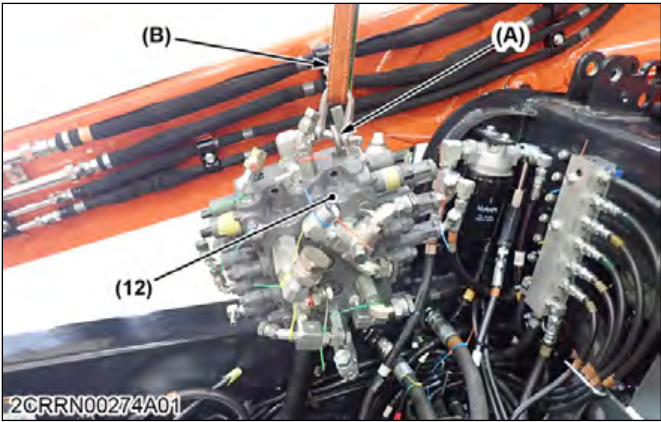
- (5) Hose clip (8) Bolt (M10 × 25) ×2
(6) Bolt (M8 × 45) ×2 (9) Stay
(7) Hose clamp ×2

6. Remove the check valve of the control valve.



- (10) Check valve

7. Insert an eye bolt to the control valve.
8. Attach a nylon sling, and hoist the control valve for support.
9. Remove the 3 bolts and the control valve.



- (11) Bolt (M10 × 70) ×3
(12) Control valve
(A) Eye bolt (M10 × 1.5)
(B) Nylon sling

Mass

(12) Control valve	Approximately 38 kg Approximately 84 lbs
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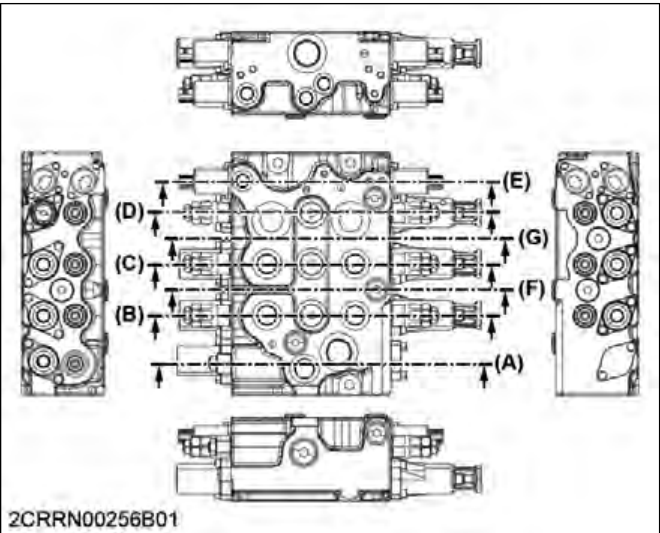
Installing

Tightening torque

(11) Bolt	48.1 to 55.9 N·m 4.9 to 5.7 kgf·m 35.5 to 41.2 lbs·ft	Thread lock (Loctite 263)
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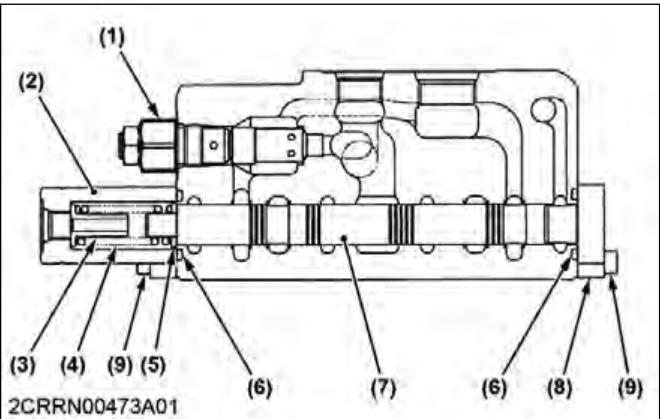
4.3.2 Control valve components

Control valve section components



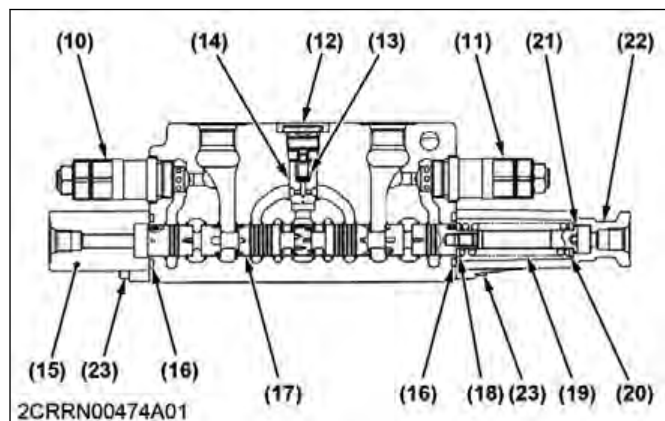
- (A) Float section
(B) Lift arm section
(C) Bucket section
(D) AUX section
(E) Solenoid section
(F) Series check valve section 1
(G) Series check valve section 2

(A) Float section



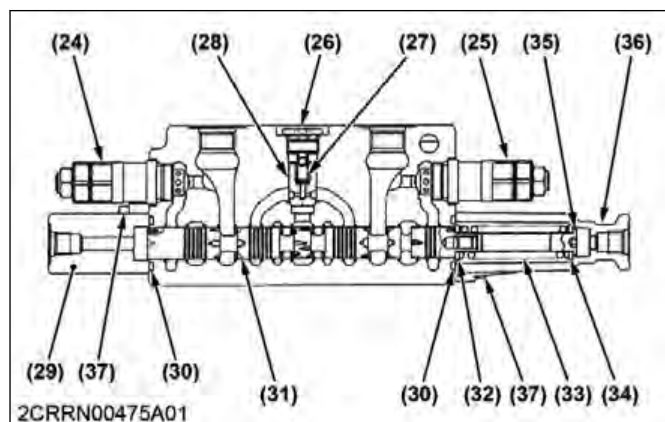
- (1) Main relief valve (aP1)
(2) Cap
(3) Spring seat
(4) Spring
(5) Spring seat
(6) O-ring ×2
(7) Spool
(8) Plate
(9) Cap bolt (M5 × 18) ×4

(B) Lift arm section



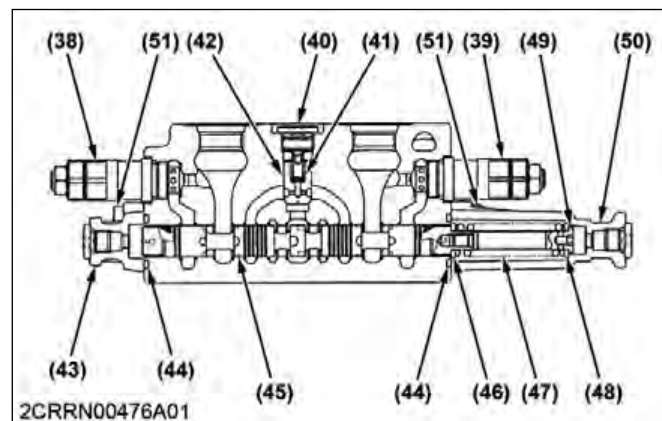
- | | |
|----------------------------------|----------------------------|
| (10) Overload relief valve (b1B) | (17) Spool |
| (11) Overload relief valve (b1R) | (18) Spring seat |
| (12) Plug | (19) Spring |
| (13) Spring | (20) Spring seat |
| (14) Poppet | (21) Spool end |
| (15) Cap | (22) Cap |
| (16) O-ring ×2 | (23) Cap bolt (M5 × 18) ×4 |

(C) Bucket section



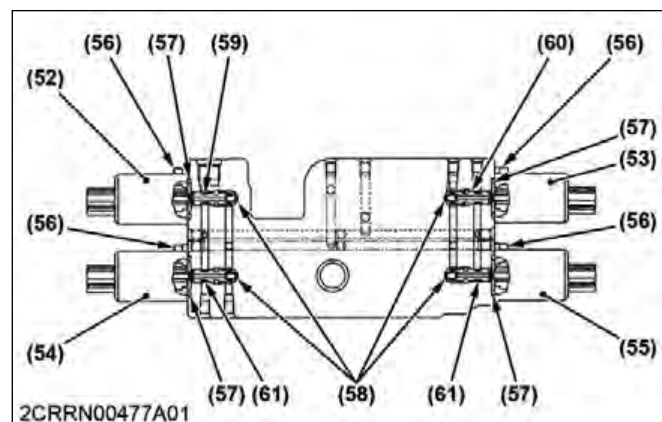
- | | |
|----------------------------------|----------------------------|
| (24) Overload relief valve (b2R) | (31) Spool |
| (25) Overload relief valve (b2B) | (32) Spring seat |
| (26) Plug | (33) Spring |
| (27) Spring | (34) Spring seat |
| (28) Poppet | (35) Spool end |
| (29) Cap | (36) Cap |
| (30) O-ring ×2 | (37) Cap bolt (M5 × 18) ×4 |

(D) AUX section

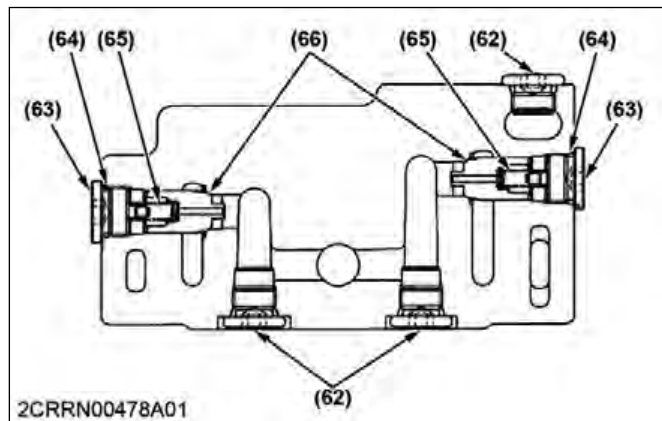


- | | |
|----------------------------------|----------------------------|
| (38) Overload relief valve (b3F) | (45) Spool |
| (39) Overload relief valve (b3M) | (46) Spring seat |
| (40) Plug | (47) Spring |
| (41) Spring | (48) Spring seat |
| (42) Poppet | (49) Spool end |
| (43) Cap | (50) Cap |
| (44) O-ring ×2 | (51) Cap bolt (M5 × 18) ×4 |

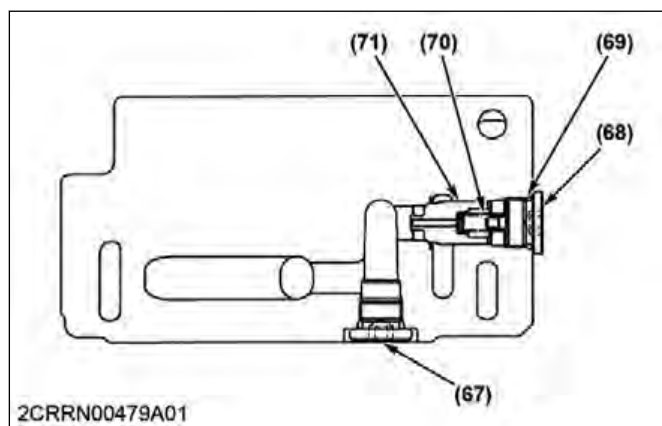
(E) Solenoid section



- | | |
|----------------------------|---------------------|
| (52) Solenoid (ac) | (57) O-ring ×4 |
| (53) Solenoid (fl) | (58) Spring ×4 |
| (54) Solenoid (a3) | (59) Spool (ac) |
| (55) Solenoid (b3) | (60) Spool (fl) |
| (56) Cap bolt (M4 × 10) ×8 | (61) Spool (a3, b3) |

(F) Series check valve section 1

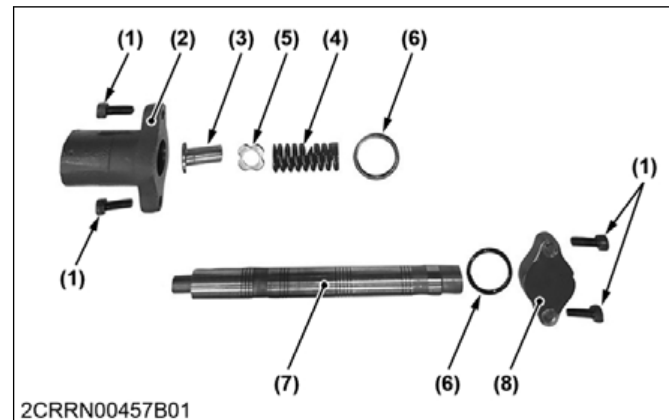
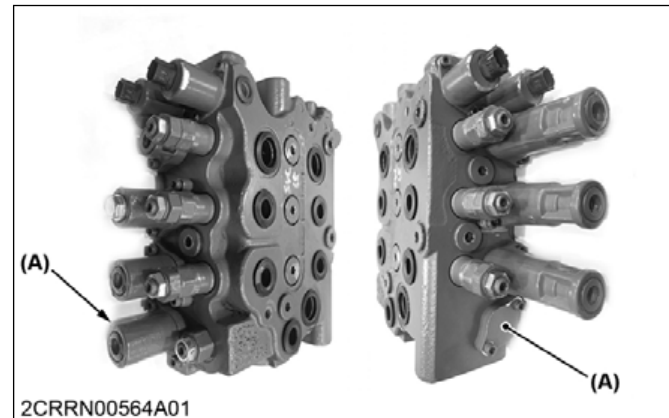
- (62) Plug ×3
(63) Plug ×2
(64) O-ring ×2
(65) Spring ×2
(66) Poppet ×2

(G) Series check valve section 2

- (67) Plug
(68) Plug
(69) O-ring
(70) Spring
(71) Poppet

Disassembling

1. Remove the component parts of the float section.

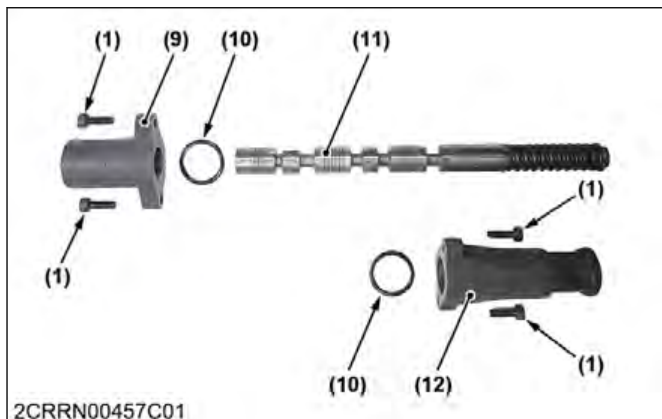
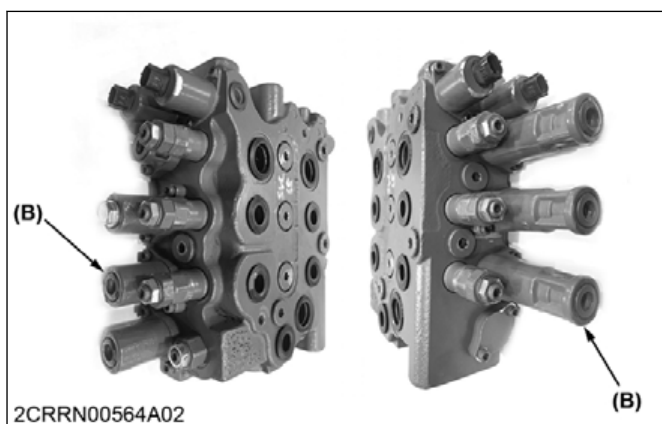


- (1) Cap bolt (M5 × 18) ×4
(2) Cap
(3) Spring seat
(4) Spring
(5) Spring seat
(6) O-ring ×2
(7) Spool
(8) Plate
(A) Float section

2. Remove the component parts of the lift arm section.

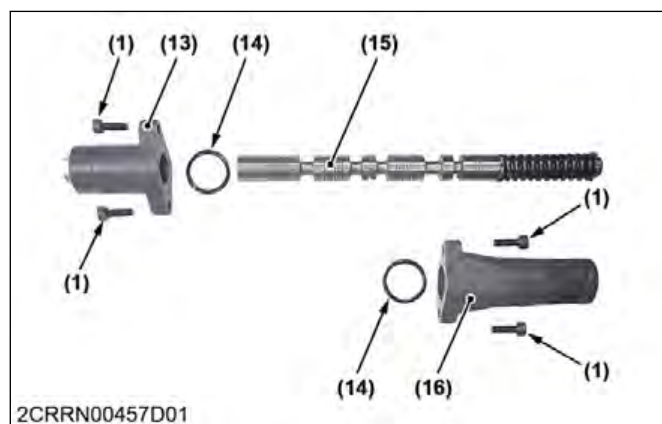
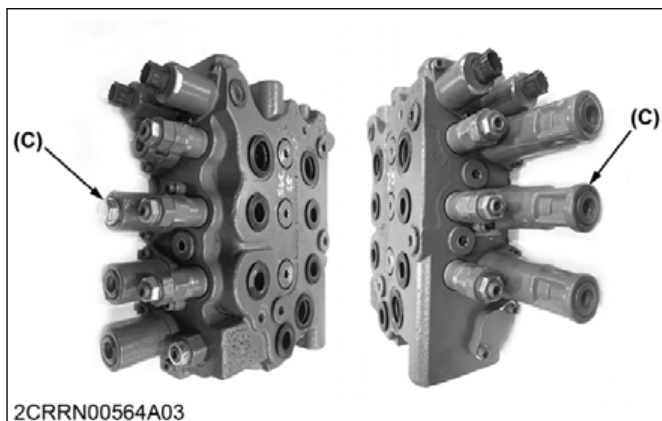
4.3.3 Disassembling and assembling the control valve**■ IMPORTANT**

- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Do not reuse removed O-rings for assembly to avoid oil leakage.
- Apply lubricant or grease to every seal to avoid damage when assembling.
- After assembly, clean the outside of the hydraulic component.



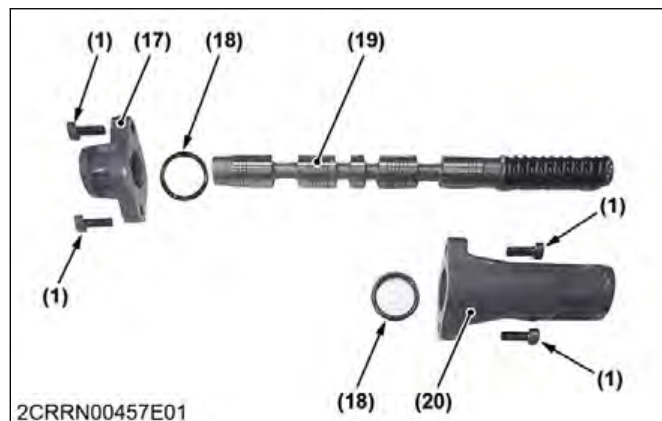
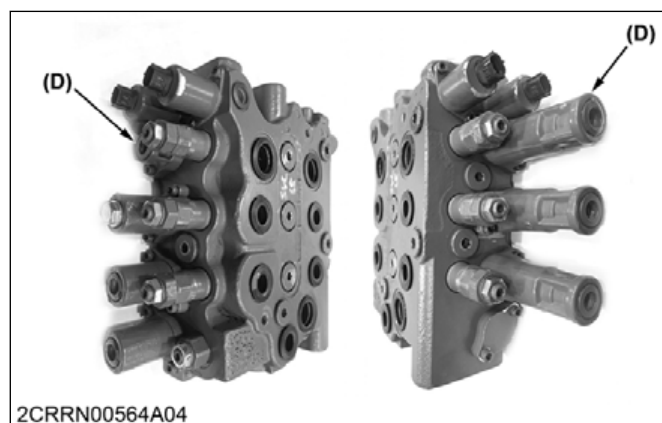
- (1) Cap bolt (M5 x 18) x4
(9) Cap
(10) O-ring x2
(11) Spool
(12) Cap
(B) Lift arm section

3. Remove the component parts of the bucket section.



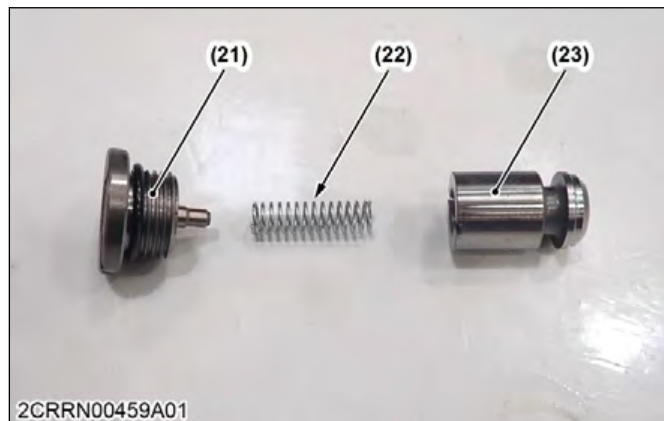
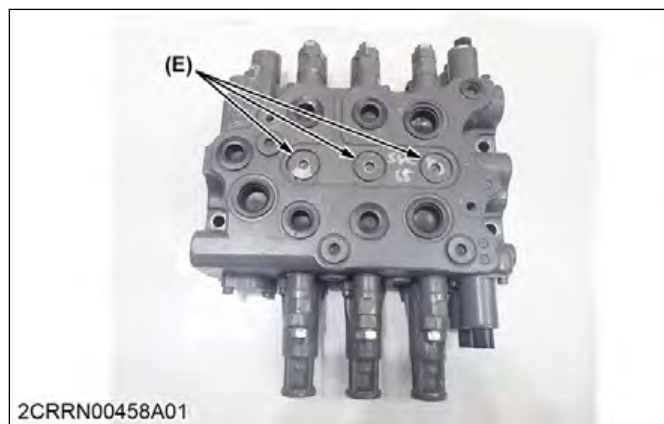
- (1) Cap bolt (M5 x 18) x4
(13) Cap
(14) O-ring x2
(15) Spool
(16) Cap
(C) Bucket section

4. Remove the component parts of the AUX section.



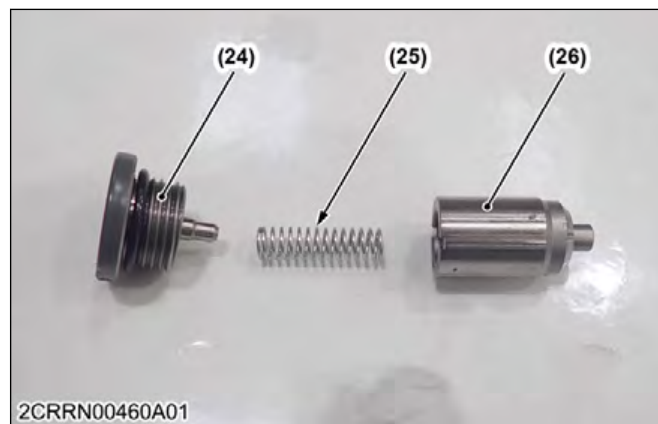
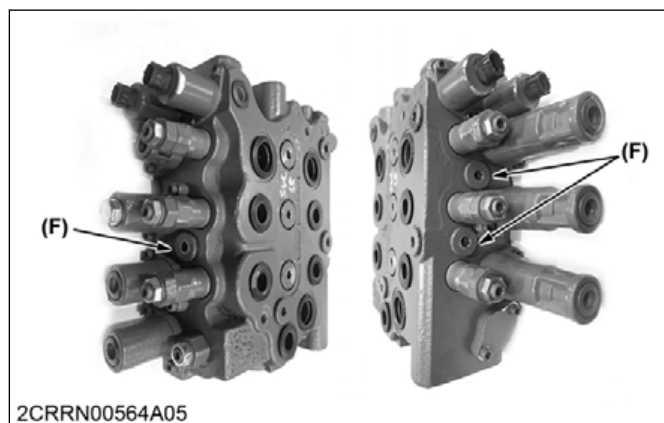
- (1) Cap bolt (M5 x 18) x4
(17) Cap
(18) O-ring x2
(19) Spool
(20) Cap
(D) AUX section

5. Remove the 3 load check valves.



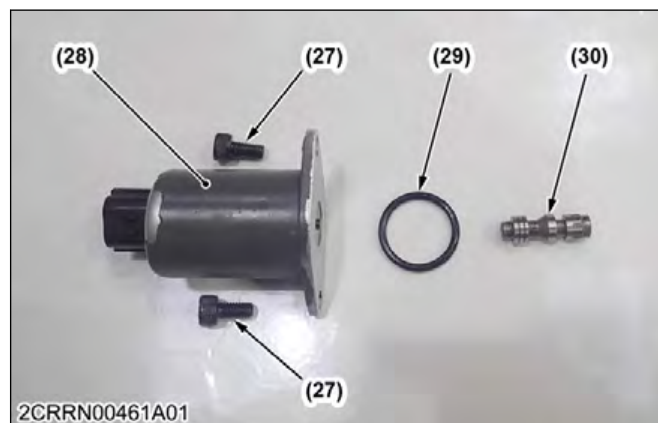
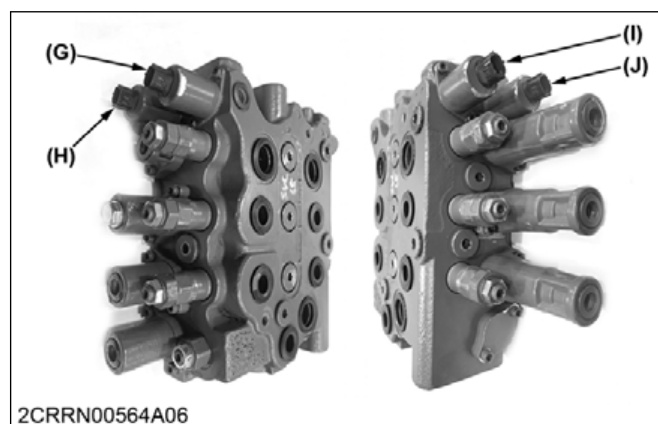
(21) Plug
(22) Spring
(23) Poppet
(E) Load check valve ×3

6. Remove the 3 series check valves.



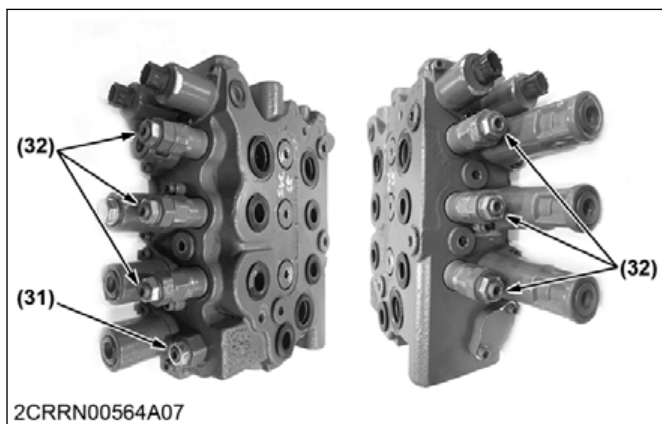
(24) Plug
(25) Spring
(26) Poppet
(F) Series check valve ×3

7. Remove the 4 solenoids.



(27) Cap bolt (M4 × 10) ×2
(28) Solenoid
(29) O-ring
(30) Spool
(G) Solenoid (ac)
(H) Solenoid (a3)
(I) Solenoid (fl)
(J) Solenoid (b3)

8. Remove the main relief valve and the 6 overload relief valves.



(31) Main relief valve

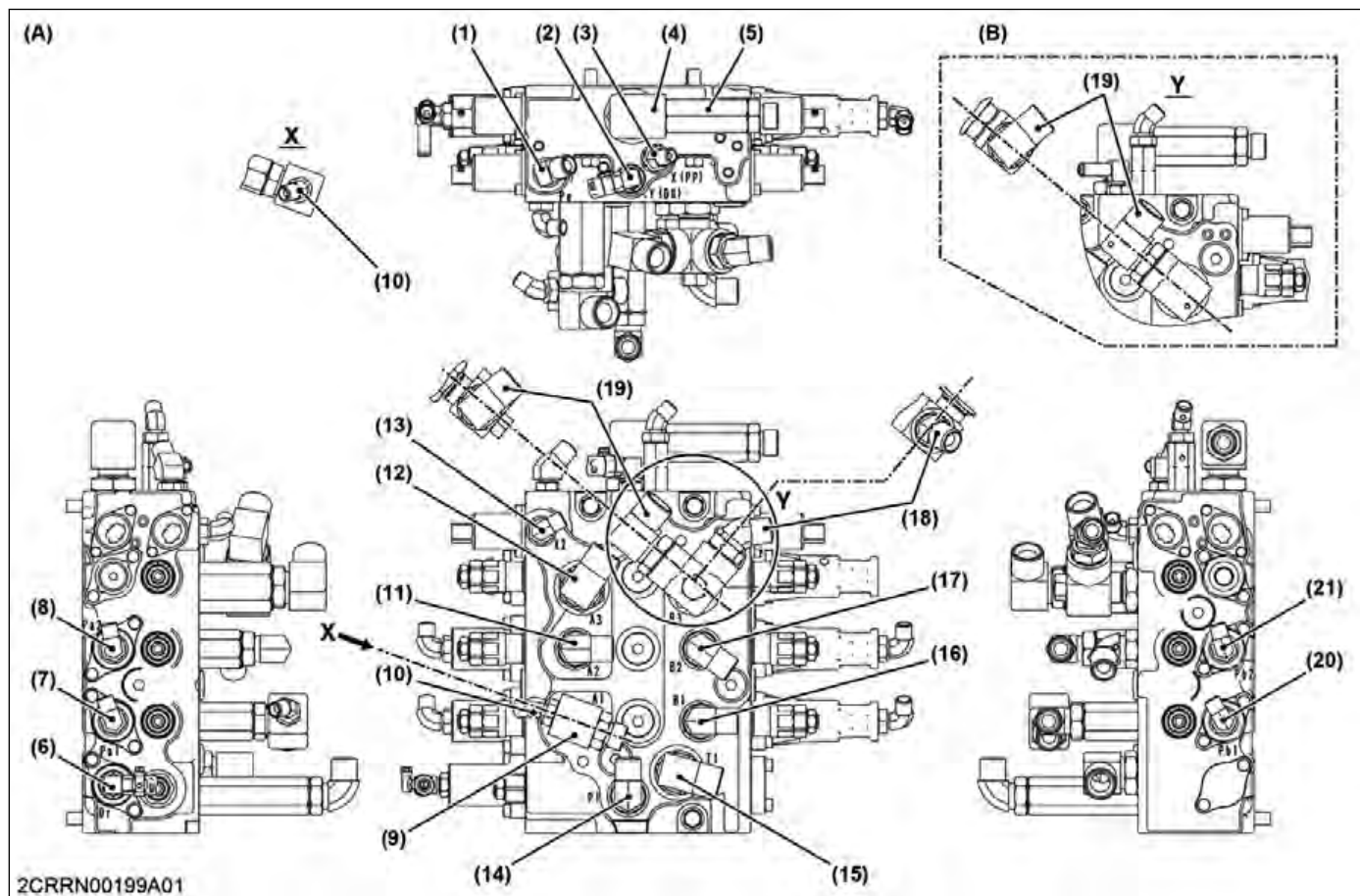
(32) Overload relief valve ×6

Assembling

Tightening torque

(1) Cap bolt	8.8 to 11 N · m 0.9 to 1.1 kgf · m 6.5 to 8.1 lbf · ft	—
(21) (24) Plug	67.7 to 73.5 N · m 6.9 to 7.5 kgf · m 49.9 to 54.2 lbf · ft	—
(27) Cap bolt	6.9 to 8.8 N · m 0.7 to 0.9 kgf · m 5.1 to 6.5 lbf · ft	—
(31) Main relief valve	49.0 to 54.0 N · m 5.0 to 5.5 kgf · m 36.1 to 39.8 lbf · ft	—
(32) Overload relief valve	59.0 to 69.0 N · m 6.0 to 7.0 kgf · m 43.5 to 50.9 lbf · ft	—

4.3.4 Installing adapters for the control valve



(A) High-flow specification

(B) Normal flow specification

No.	Port	Adapter size	Adapter angles	Remarks
(1)	Pp	G1/4-G3/8	20°	
(2)	Y (DR)	G3/8-φ10 mm (φ0.4 in.)	15°	
(3)	X (PP)	G1/4-G1/4	10°	
(4)	T	G6/8-G1/2	—	Control valve side
(5)		G1/2-G1/2	—	Check valve
(6)	Dr	G1/4-φ10 mm (φ0.4 in.)	—	
(7)	Pa1	G1/4-G1/4	20°	
(8)	Pa2	G1/4-G1/4	10°	
(9)	A1	G1/2-G1/2	20°	To lift arm cylinder bottom
(10)		G1/4-G1/4	55°	To hydraulic oil tank
(11)	A2	G1/2-G1/2	—	
(12)	A3	G3/4-G3/4	55°	
(13)	X2	G1/4-G1/4	30°	
(14)	P	G1/2-G1/2	—	
(15)	T1	G3/4-G3/4	15°	
(16)	B1	G1/2-G1/2	—	

(Continued)

No.	Port	Adapter size	Adapter angles	Remarks
(17)	B2	G1/2-G1/2	35°	
(18)	B3	G1/2-G1/2	45°	Control valve side
			10°	Hose side
(19)		G3/4-G3/4	40°	Control valve side
			10°	Hose side
(20)	Pb1	G1/4-G1/4	30°	
(21)	Pb2	G1/4-G1/4	15°	

4.4 HST motor

4.4.1 Removing and installing the HST motor

CAUTION

- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.

IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

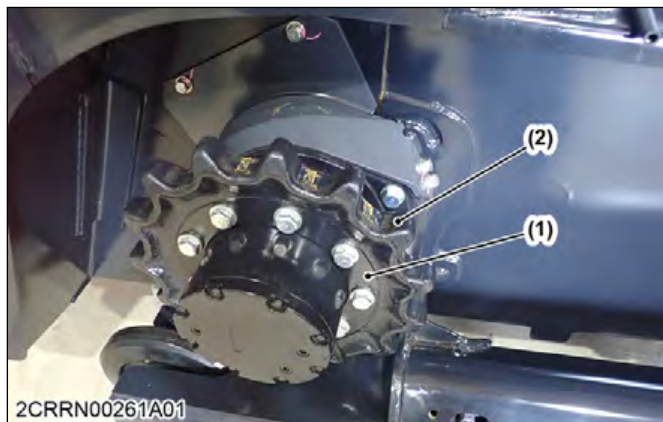
Preparing

- Park the machine on the firm and level ground.
- Jack up the machine.
- Lower the front attachment and stop the engine.
- Remove the track.
- Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.



Removing

- Remove the 9 bolts and the sprocket.



- (1) Bolt (M16 × 50) × 9 (2) Sprocket

Mass

(2) Sprocket	Approximately 17 kg Approximately 37 lbs
--------------	---

- Remove the 6 bolts and the 2 covers.



- (3) Bolt (M12 × 35) × 6 (5) Cover
(4) Cover

- Disconnect the hydraulic hoses from the HST motor.



- Attach a nylon sling, and hoist the HST motor for support.
- Remove the 9 bolts and the HST motor.



- (6) Bolt (M16 × 50) × 9 (A) Nylon sling
(7) HST motor

Mass

(7) HST motor	Approximately 62 kg Approximately 137 lbs
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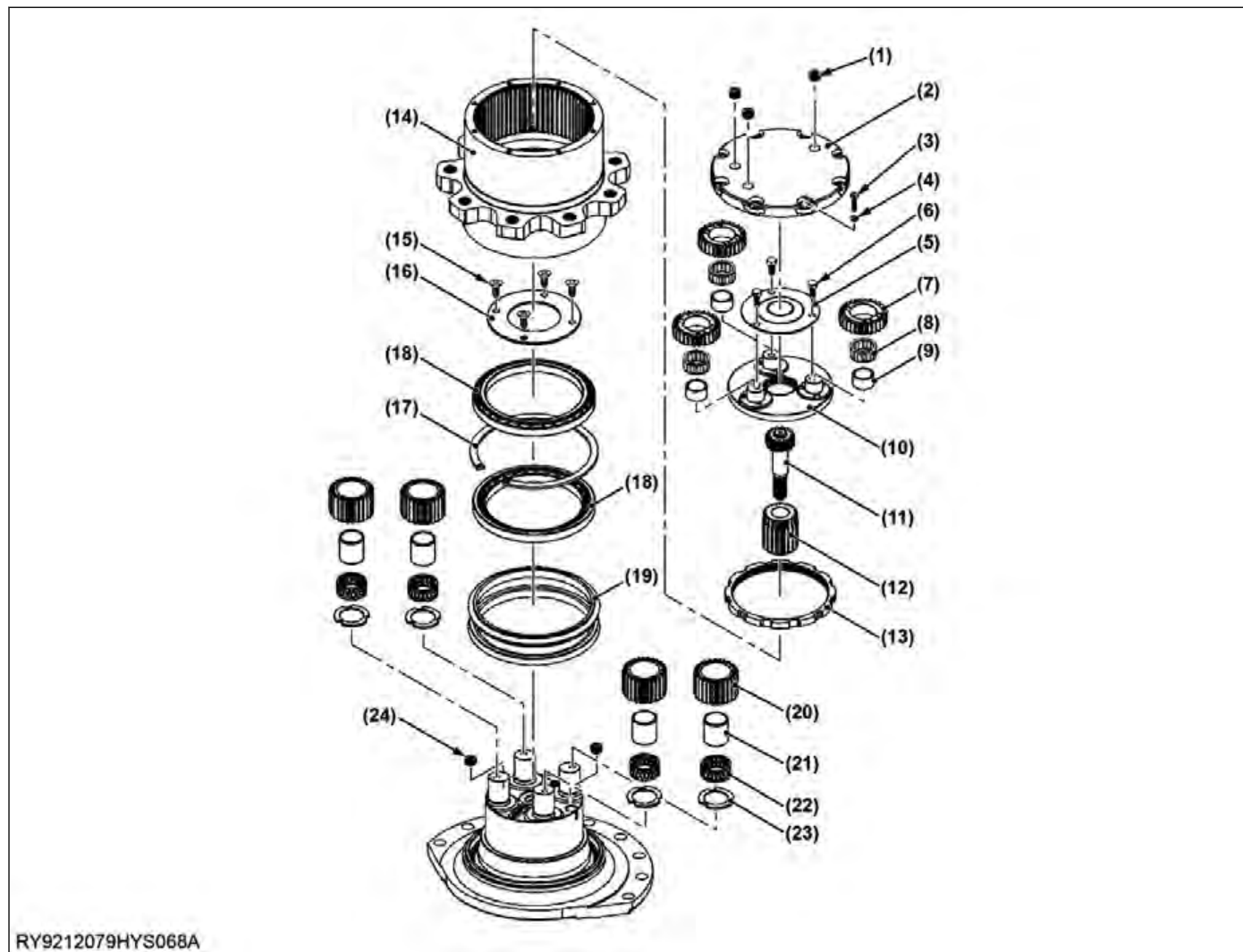
Installing

Tightening torque

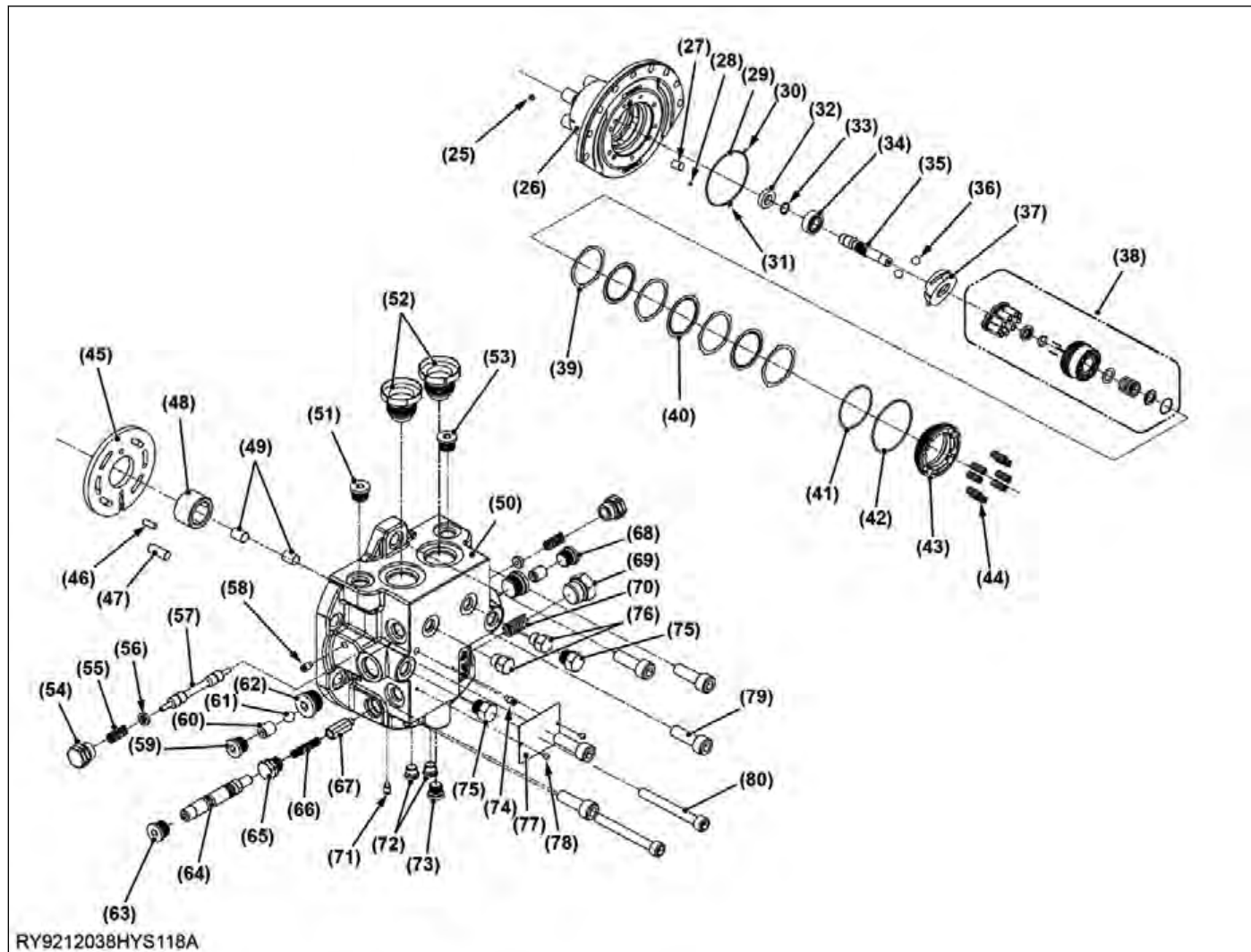
(1) (6) Bolt	259.9 to 304.0 N · m 26.5 to 31.0 kgf · m 191.7 to 224.2 lbf · ft	Thread lock (Loctite 271)
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4.4.2 HST motor components

Reduction gear case



- | | | | |
|---------------------------|-----------------------------|---------------------------|-------------------------------|
| (1) Plug ×3 | (7) First planetary gear ×3 | (13) Ring nut | (19) Floating seal kit |
| (2) Cover | (8) Inner race ×3 | (14) Ring gear | (20) Second planetary gear ×4 |
| (3) Cap bolt (M6 × 25) ×8 | (9) First needle bearing ×3 | (15) Bolt ×4 | (21) Inner race ×4 |
| (4) Washer ×8 | (10) Carrier plate | (16) Second stopper plate | (22) Second needle bearing ×4 |
| (5) First stopper plate | (11) First sun gear | (17) Snap ring | (23) Washer ×4 |
| (6) Bolt ×3 | (12) Second sun gear | (18) Angular bearing ×2 | (24) Plug ×2 |

Hydraulic motor

(25) Plug	(39) Separate plate ×4	(53) Plug	(67) Poppet
(26) Housing	(40) Friction plate ×3	(54) Plug ×2	(68) Plug
(27) Control piston	(41) O-ring	(55) Spring ×2	(69) Plug
(28) Orifice	(42) O-ring	(56) Guide ×2	(70) Spring
(29) O-ring	(43) Brake piston	(57) Spool	(71) Plug
(30) O-ring	(44) Brake spring ×8	(58) Plug	(72) Plug ×2
(31) O-ring	(45) Valve plate	(59) Plug ×2	(73) Plug
(32) Oil seal	(46) Pin	(60) Seat plug ×2	(74) Plug
(33) Retaining ring	(47) Pin	(61) Ball	(75) Plug ×2
(34) Roller bearing	(48) Needle bearing	(62) Plug ×2	(76) Plug ×2
(35) Shaft	(49) Pin ×2	(63) Plug	(77) Name plate
(36) Ball ×2	(50) End cap	(64) Spool	(78) Screw ×2
(37) Swash plate	(51) Plug	(65) Plug	(79) Cap bolt (M10 × 30) ×5
(38) Cylinder block kit	(52) Plastic plug ×2	(66) Spring	(80) Cap bolt (M8 × 70) ×2

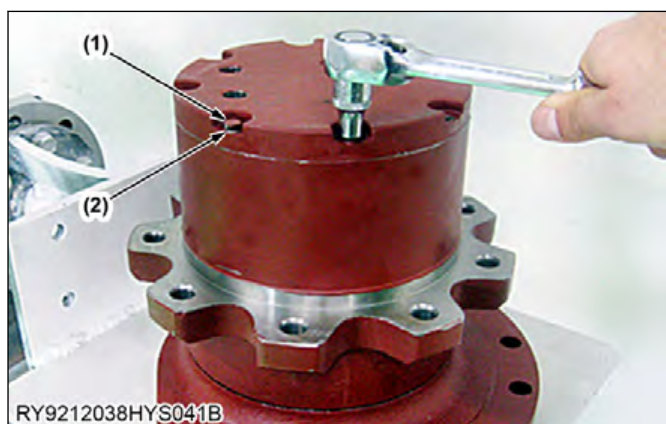
4.4.3 Disassembling the HST motor**■ IMPORTANT**

- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.

- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.

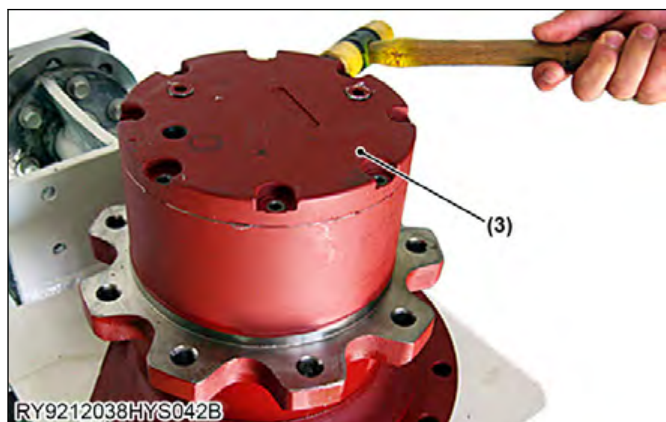
Disassembling the gear case

1. Remove the 8 cap bolts and washers.



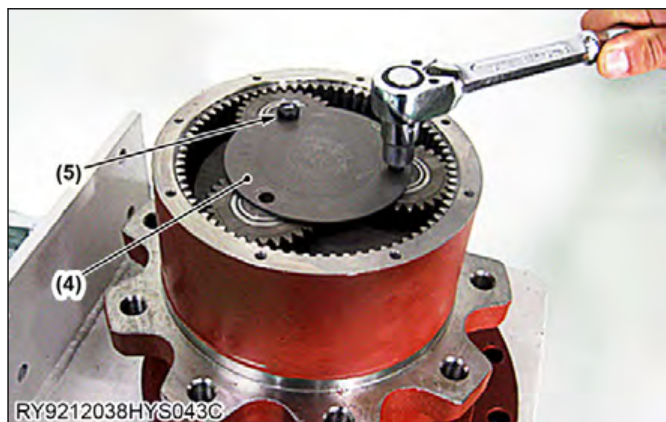
(1) Cap bolt (M6 × 25) × 8 (2) Washer × 8

2. Hit the cover with a plastic hammer to remove.



(3) Cover

3. Remove the 3 bolts. Remove the first stopper plate.



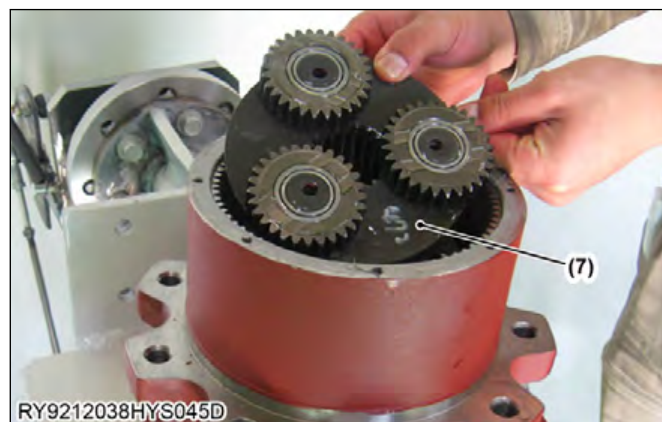
(4) First stopper plate (5) Bolt (M8 × 20) × 3

4. Remove the first sun gear.



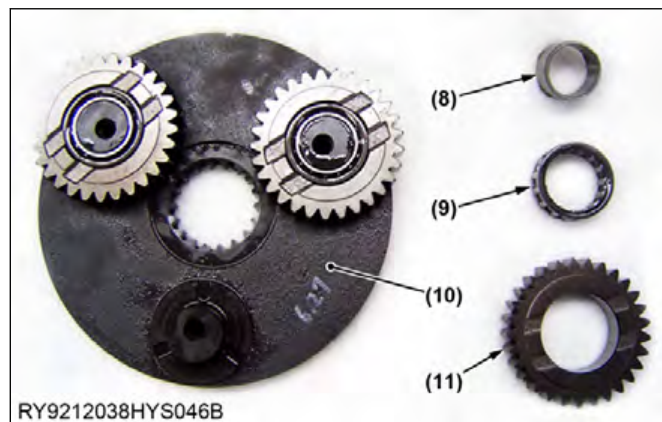
(6) First sun gear

5. Remove the first carrier assembly.



(7) First carrier assembly

6. Disassemble the first carrier assembly.



(8) Inner race × 3 (11) First planetary gear × 3
(9) First needle bearing × 3
(10) First carrier

7. Remove the second sun gear.



(12) Second sun gear

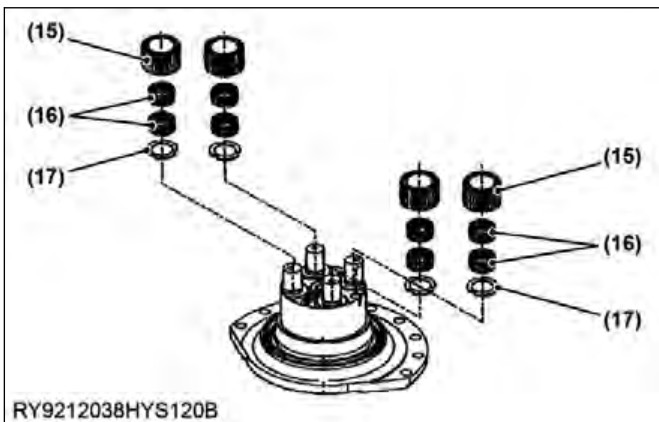
8. Remove the 4 bolts. Remove the second stopper plate.



(13) Bolt (M8 ×20) ×4

(14) Second stopper plate

9. Remove the 4 second planetary gears, the 8 second needle bearing, and the 4 washers.

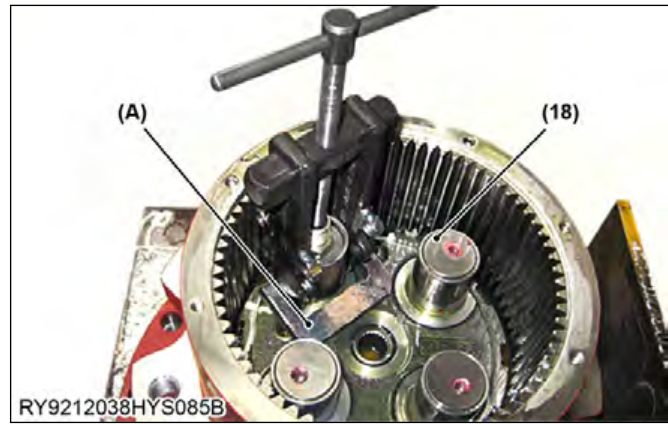


(15) Second planetary gear ×4

(17) Washer ×4

(16) Second needle bearing ×8

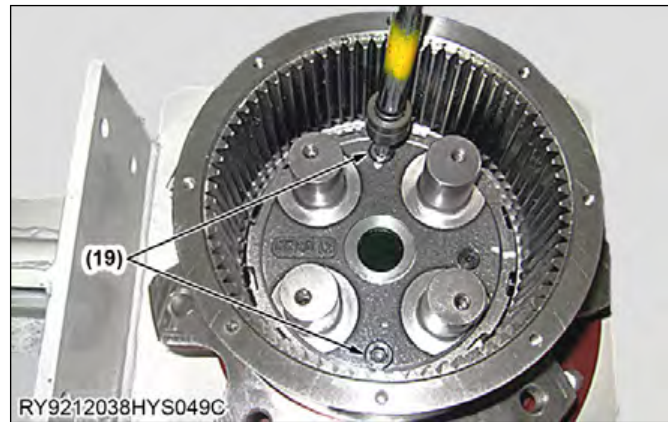
10. Remove the 4 inner races with the inner race puller.



(18) Inner race ×4

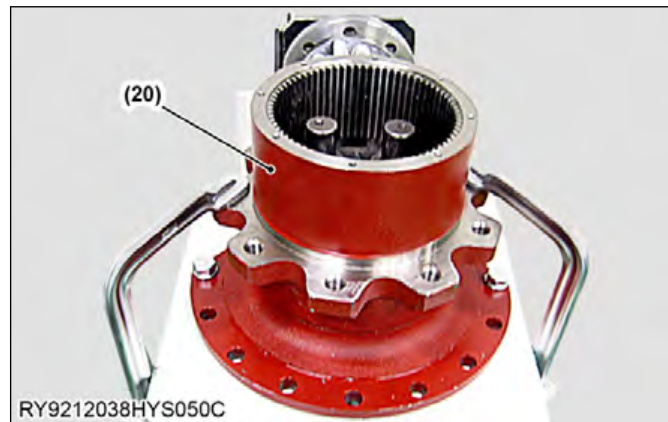
(A) Inner race puller

11. Remove the 2 socket plugs.



(19) Socket plug ×2

12. Hold the ring gear securely with clamps.



(20) Ring gear

13. Remove the ring nut with the ring nut wrench.



(B) Ring nut wrench

14. Remove the ring gear with a puller.

NOTE

- If puller is unavailable, hit the left and right of the ring gear alternately with a plastic hammer.



(20) Ring gear

(21) Housing

15. Remove the floating seal with flat tip screwdrivers.



(22) Floating seal

16. Remove the floating seal with flat tip screwdrivers.

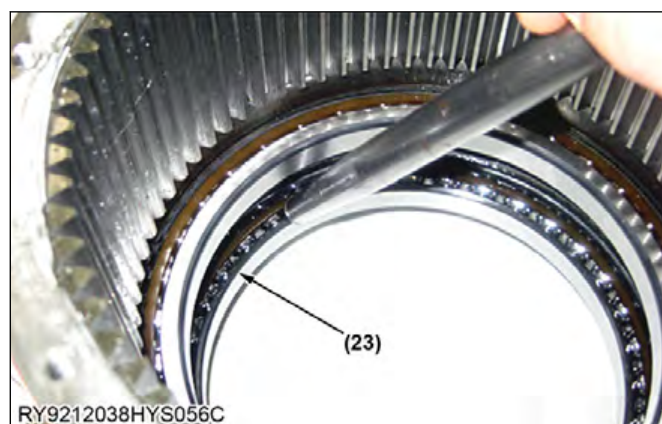


(22) Floating seal

17. Remove the outer angular bearing with a hammer and pin punch.

NOTE

- Hit the angular bearing with a pin punch evenly.
- Do not reuse the angular bearing.



(23) Angular bearing

18. Remove the 2 snap rings with snap ring pliers.



(24) Snap ring x2

19. Remove the angular bearing inner angular bearing with a hammer and pin punch.

■ NOTE

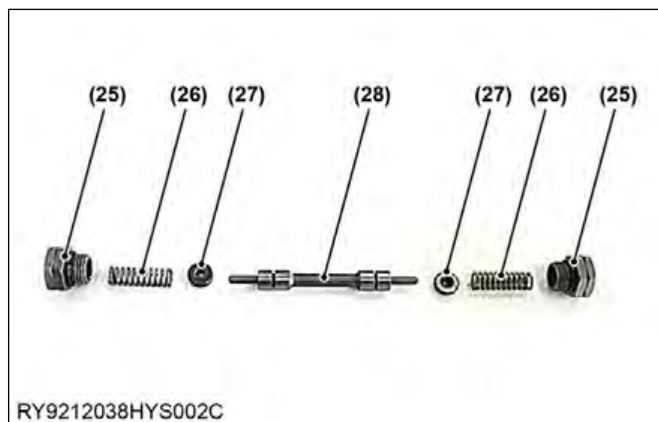
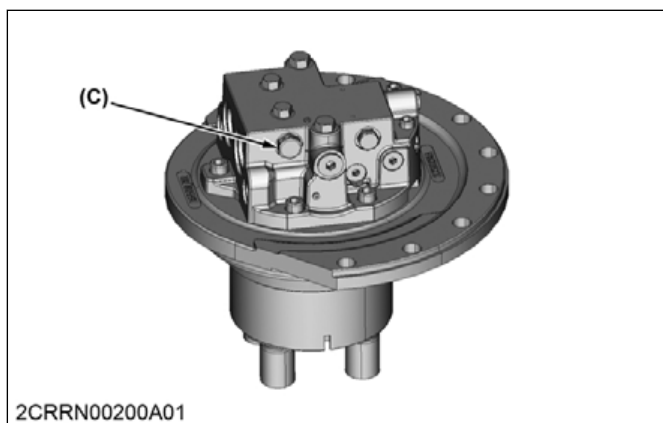
- Hit the angular bearing with a pin punch evenly.
- Do not reuse the angular bearing.



(23) Angular bearing (24) Snap ring

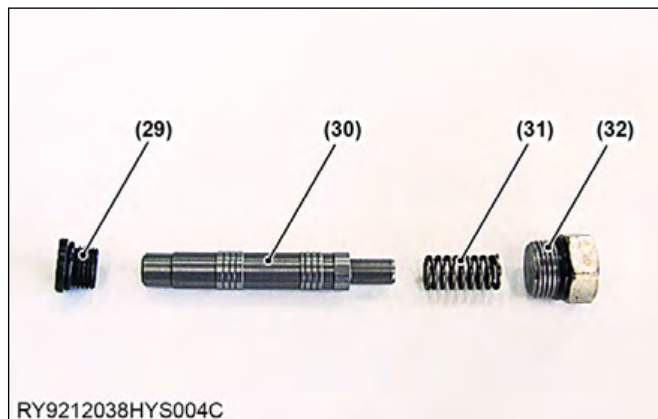
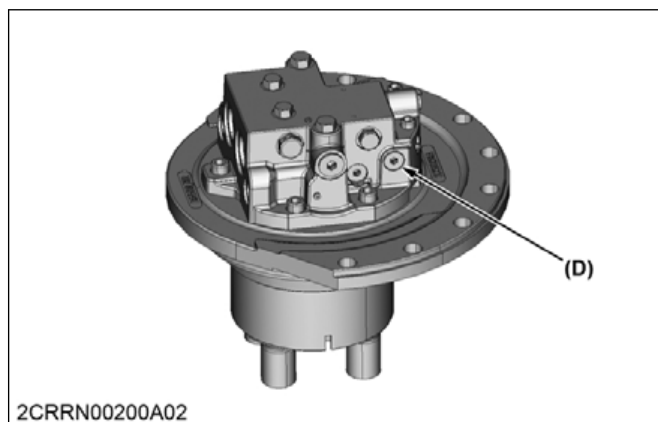
Disassembling the hydraulic motor

1. Remove the flushing valve component.



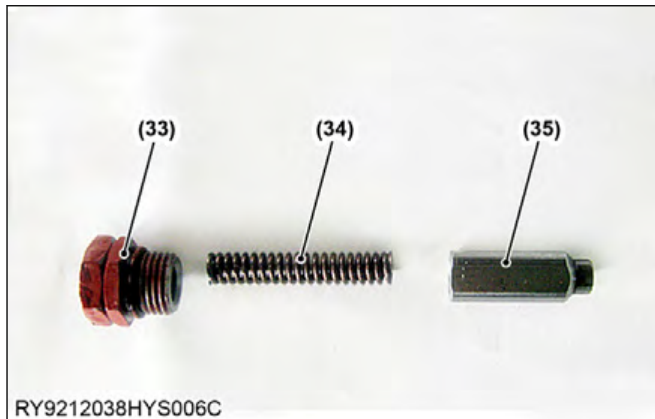
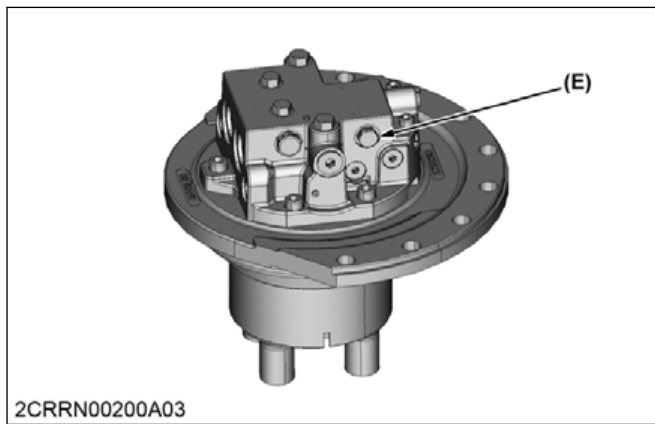
(25) Plug with O-ring ×2 (28) Spool
(26) Spring ×2 (C) Flushing valve component
(27) Guide ×2

2. Remove the travel speed shift valve component.



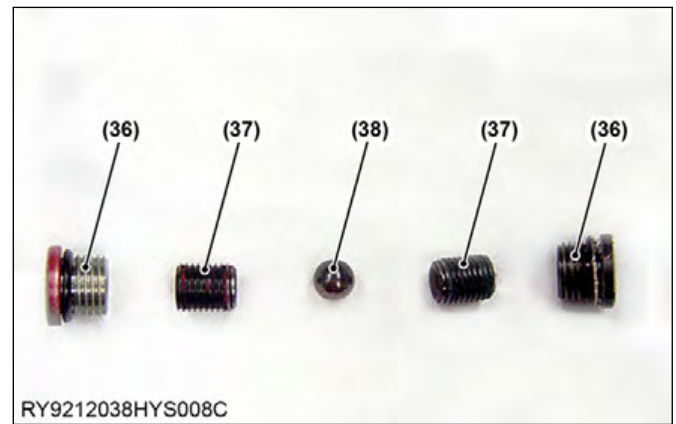
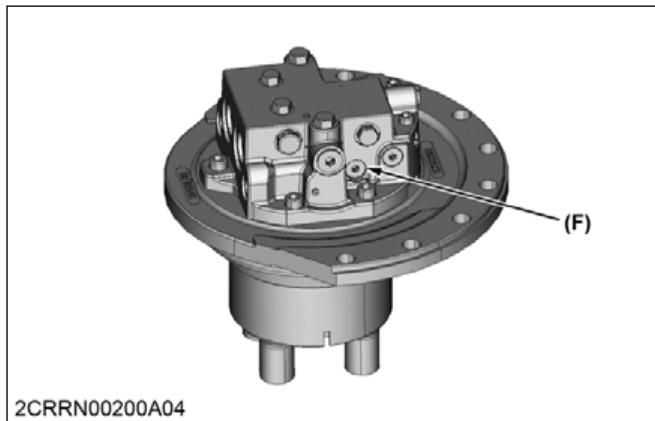
(29) Plug with O-ring (D) Travel speed shift valve component
(30) Spool
(31) Spring
(32) Plug with O-ring

3. Remove the flushing relief valve component.



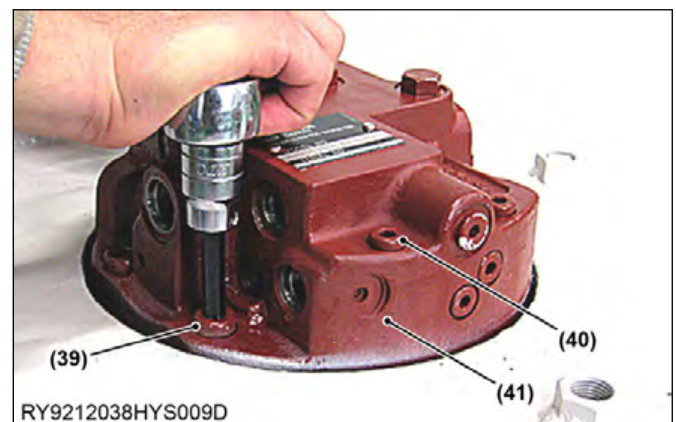
(33) Plug with O-ring
(34) Spring
(35) Poppet
(E) Flushing relief valve component

4. Remove the high pressure selector valve component.



(36) Plug with O-ring x2
(37) Sheet plug x2
(38) Ball
(F) High pressure selector valve component

5. Remove the 7 cap bolts from the end cap.

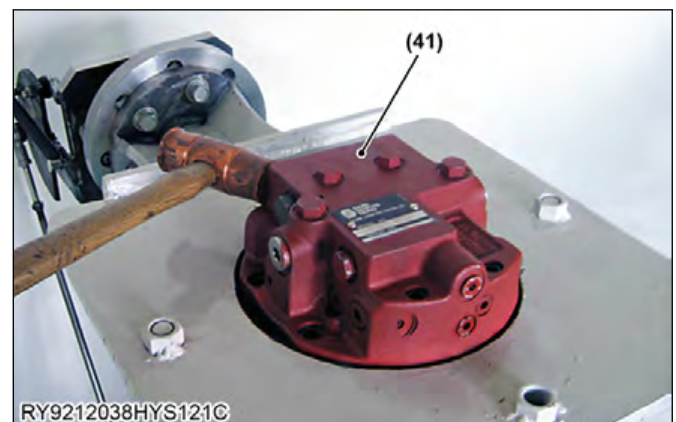


(39) Cap bolt (M10 × 30) × 5
(40) Cap bolt (M8 × 70) × 2
(41) End cap

6. Remove the end cap with a hammer and flat tip screwdrivers.

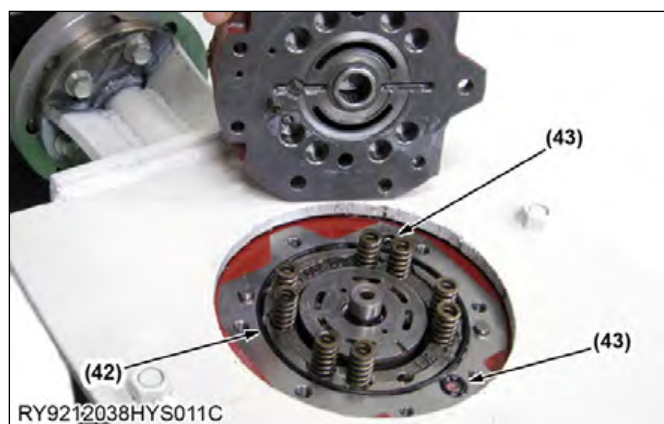
NOTE

- Be careful not to damage the end cap with flat tip screwdrivers.



(41) End cap

7. Remove the 3 O-rings with a flat tip screwdriver.



(42) O-ring

(43) O-ring x2

8. Remove the valve plate.



(44) Valve plate

9. Remove the 8 brake springs.



(45) Brake spring x8

10. Remove the brake piston by blowing air from the brake release oil passage hole.

NOTE

- When blowing air into the brake release oil passage hole, hold down the brake piston so that the brake piston does not fly out.



RY9212038HYS015C



(46) Brake piston

(G) Brake release oil passage hole

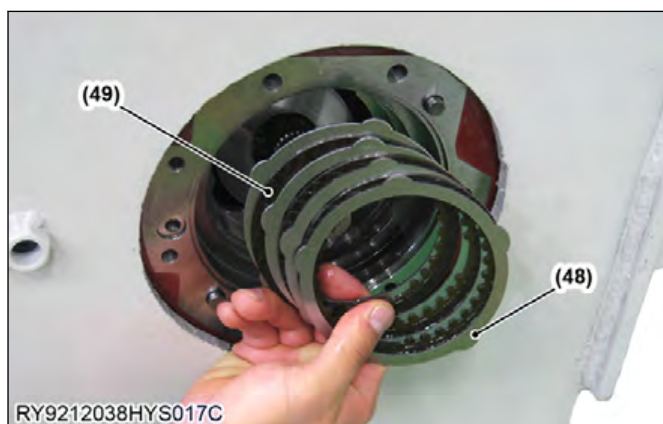
(H) Travel speed shift oil passage hole

11. Turn the working platform 90°. Remove the cylinder block kit.



(47) Cylinder block kit

12. Remove the 4 separate plates and the 3 friction plates.



(48) Separate plate ×4 (49) Friction plate ×3

13. Remove the swash plate.



(50) Swash plate

14. Turn the working platform 90°. Remove the shaft together with the roller bearing.



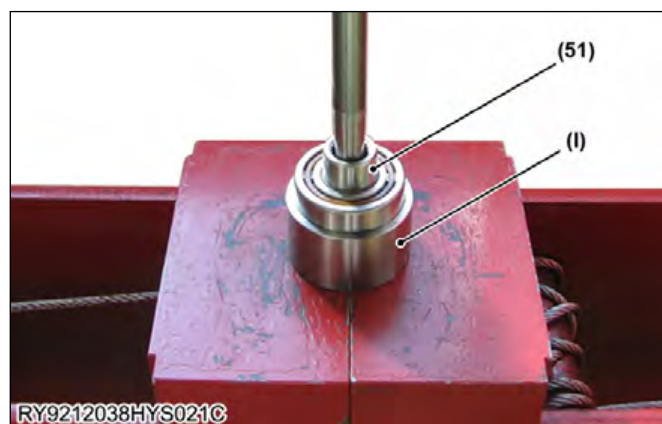
(51) Shaft (52) Roller bearing

15. Remove the retaining ring with snap ring pliers.



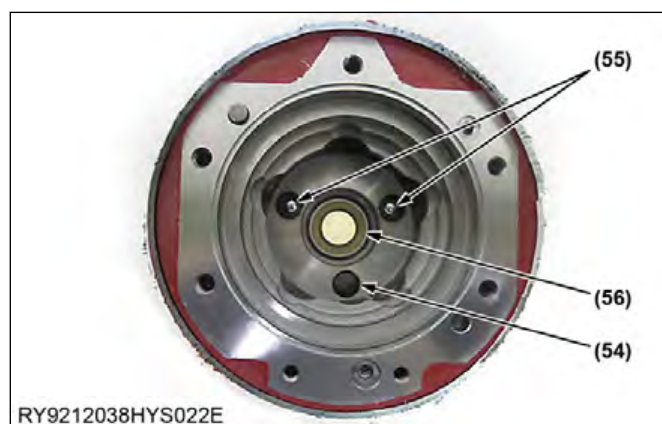
(53) Retaining ring

16. Remove the shaft with a press and the roller bearing removal and installation jig.



(51) Shaft (I) Roller bearing removal and installation jig

17. Remove the control piston and the 2 balls.



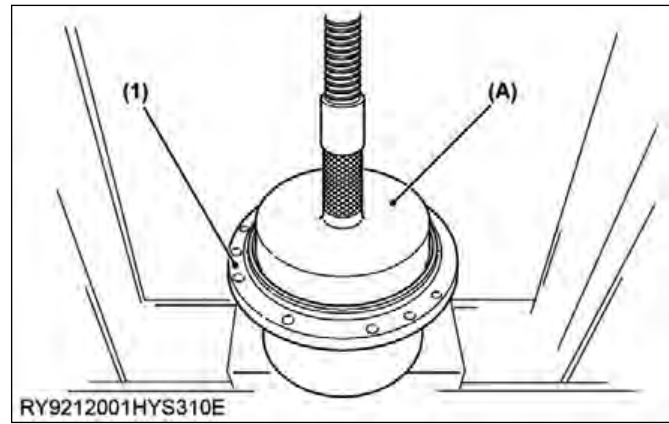
(54) Control piston (55) Ball ×2 (56) Oil seal

18. Turn the working platform 180°. Remove the oil seal with a hammer and a flat tip screwdriver.



(21) Housing

(56) Oil seal



(1) Angular bearing

(A) Angular bearing installation jig

2. Install the 2 snap rings with snap ring pliers, and install the other angular bearing.

■ NOTE

- Make sure that the angular bearings are assembled in the right direction.



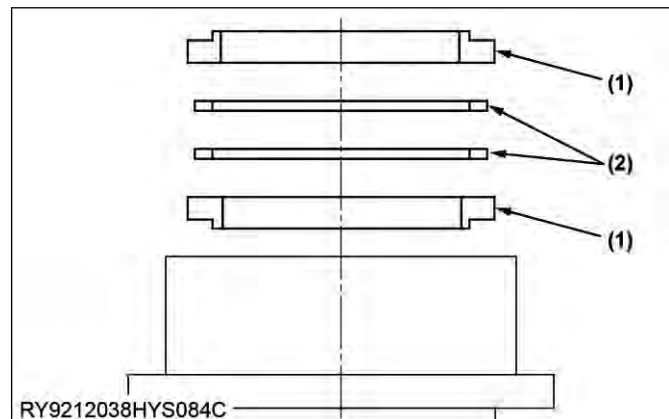
4.4.4 Assembling the HST motor

■ IMPORTANT

- Do not reuse the used O-rings, oil seals or the like, in order to avoid oil leakage.
- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages on the sliding and mating surface carefully for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- After assembling, clean the outside of the hydraulic component.

Assembling the gear case

1. Install the angular bearing into the ring gear with a press and the angular bearing installation jig.



(1) Angular bearing ×2

(2) Snap ring ×2

3. Thread the 4 bolt holes in the housing.



(B) Bolt hole ×4 (C) Thread (M8 × 1.25)

4. Clean the 4 bolt holes with a vacuum pump.



5. Place the floating seal installation jig (guide) onto the housing. Install the O-ring and the floating seal.

■ NOTE

- Grease the O-ring.



(3) O-ring (4) Floating seal (5) Housing (D) Floating seal installation jig (guide)

6. Press the floating seal with the floating seal installation jig (pusher).



(E) Floating seal installation jig (pusher)

7. Place the floating seal installation jig (guide) onto the ring gear. Install the O-ring and the floating seal.

■ NOTE

- Grease the O-ring.



(3) O-ring (4) Floating seal (6) Ring gear (D) Floating seal installation jig (guide)

8. Press the floating seal with the floating seal installation jig (pusher).



(E) Floating seal installation jig (pusher)

9. Apply gear oil to the sliding surface of the floating seal on the ring gear.

■ NOTE

- Apply gear oil to 4 locations at 90° intervals.

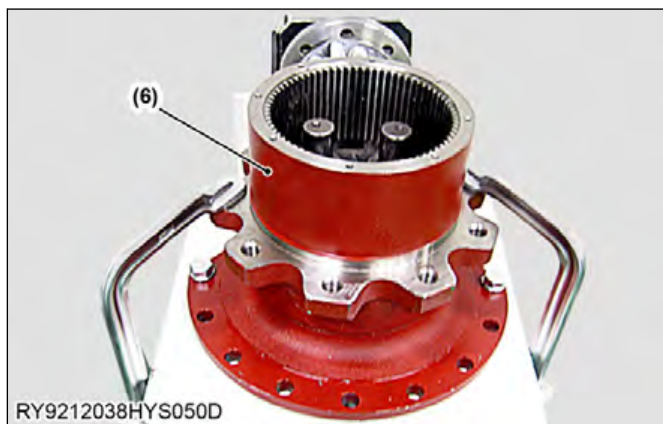


10. Install the ring gear onto the housing.



(5) Housing (6) Ring gear

11. Hold the ring gear securely with clamps.

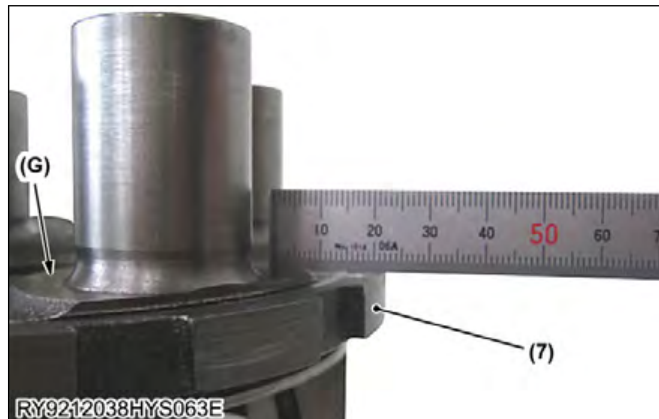
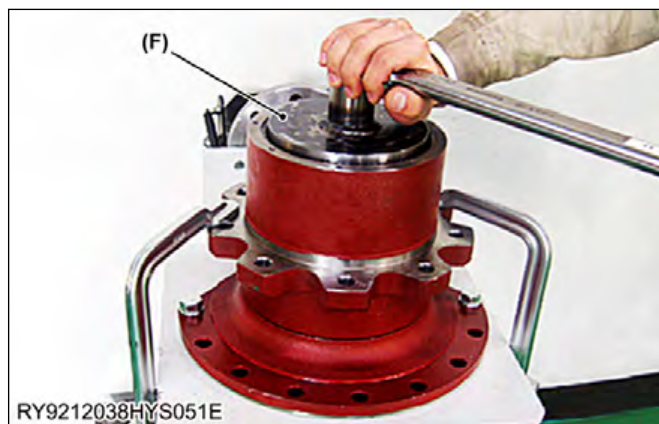


(6) Ring gear

12. Tighten the ring nut with the ring nut wrench.

■ NOTE

- After tightening, check if the top surface of the ring nut is lower than the boss.



(7) Ring nut

(G) Boss

(F) Ring nut wrench

Tightening torque

(7) Ring nut	220 to 340 N · m 22.4 to 34.7 kgf · m 162 to 251 lbf · ft	—
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13. Install a test bolt into the sprocket mounting hole. Measure the rotation torque of the gear case with a push-pull gauge.

■ NOTE

- If the torque is lower than the specification, tighten the ring nut.
- If the torque is higher than the specification, loosen the ring nut.



(H) Test bolt (M16)

(I) Push-pull gauge

Service specification

Rotation torque	Gear case	11 to 15 N·m 1.2 to 1.5 kgf·m 8.1 to 11.0 lbf·ft
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14. Install the 2 socket plugs.



(8) Socket plug ×2

Tightening torque

(8) Socket plug	30 N·m 3.1 kgf·m 22 lbf·ft	—
-----------------	----------------------------------	---

15. Install the 4 inner races into the housing with a hammer and the oil seal installation jig.

NOTE

- Apply gear oil to the inner surface of the inner races.



(9) Inner race ×4

(J) Oil seal installation jig

16. Install the 4 washers.

NOTE

- Make the chamfered side of the washers face downward.



(10) Washer ×4

17. Install the 8 second needle bearings.



(11) Second needle bearing ×8

18. Install the 4 second planetary gears.



(12) Second planetary gear ×4

19. Install the second stopper plate and the 4 bolts.



(13) Second stopper plate

(14) Bolt (M8 × 20) ×4

Tightening torque

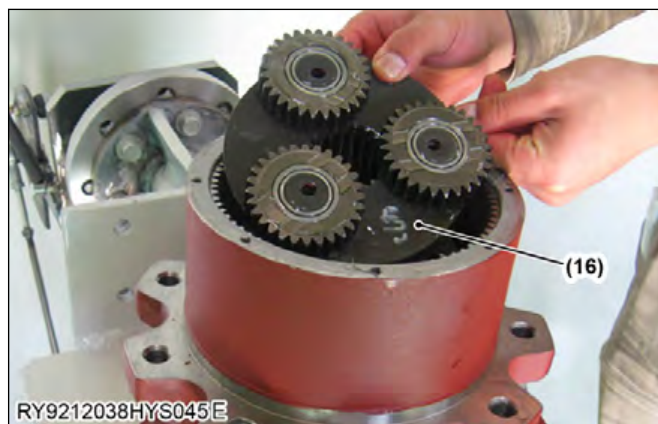
(14) Bolt	20 N · m 2.0 kgf · m 15 lbf · ft	—
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20. Install the second sun gear.



(15) Second sun gear

21. Install the first carrier assembly.



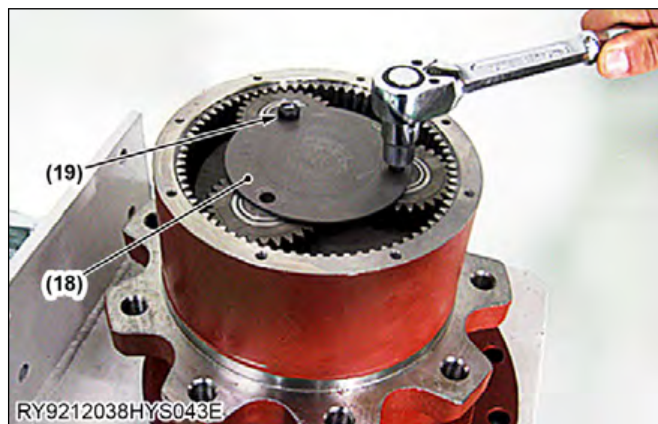
(16) First carrier assembly

22. Install the first sun gear.



(17) First sun gear

23. Install the first stopper plate the 3 bolts.



(18) First stopper plate

(19) Bolt (M8 × 20) ×3

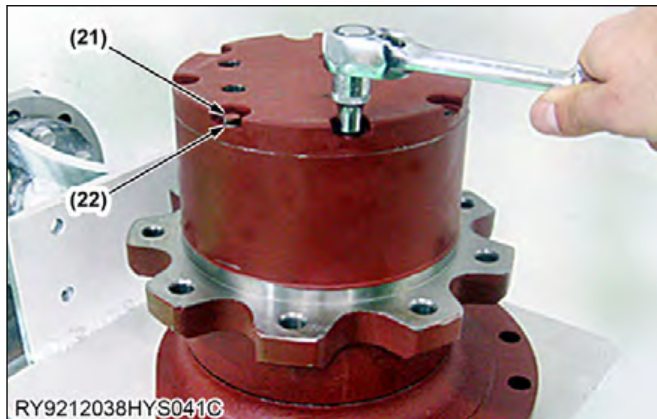
Tightening torque

(19) Bolt	25 N · m 2.5 kgf · m 18 lbf · ft	—
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24. Install and fix the cover with the 8 bolts and washers.

NOTE

- Apply ThreeBond® 1215 to the flange of the cover.



(20) Cover
(21) Bolt (M6 × 25) × 8
(22) Washer

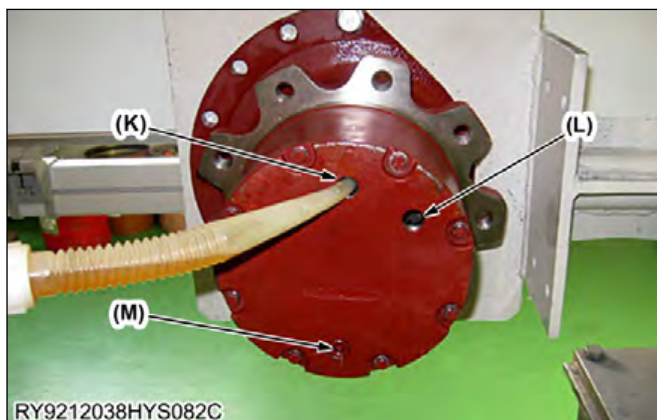
Tightening torque

(21) Bolt	16 N · m 1.6 kgf · m 12 lbf · ft	—
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25. Turn the working platform 90°. Replenish gear oil into the gear case.

NOTE

- Wrap sealing tape around the plugs.



(K) Oil supply port
(L) Oil inspection port
(M) Oil drain port

Lubrication oil

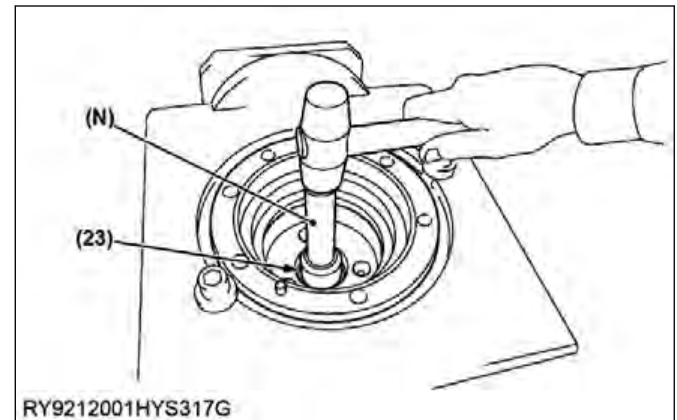
HST motor	1.0 L 0.26 U.S.gals	SAE 90
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Assembling the hydraulic motor

1. Install the oil seal into the housing with the oil seal installation jig.

NOTE

- Make the rubber side face downward.

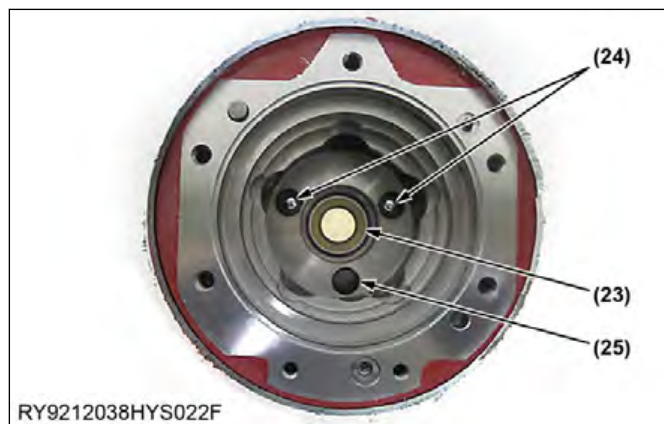


(23) Oil seal
(N) Oil seal installation jig
(O) Metal side
(P) Rubber side

2. Install the 2 balls and the control piston.

NOTE

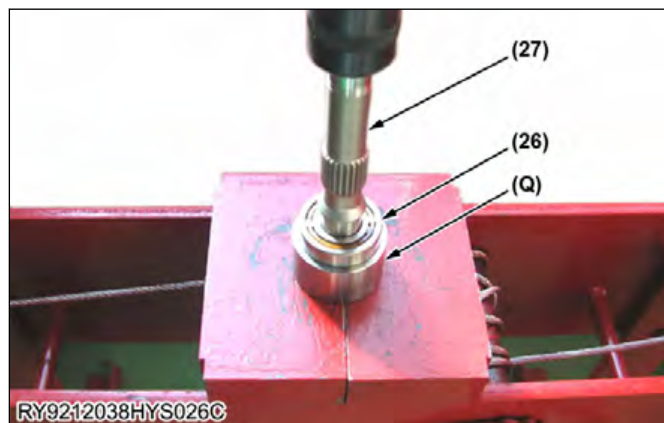
- Grease the 2 balls.
- Check for scratches or damages on the sliding surface of the control piston.



(23) Oil seal
(24) Ball ×2

(25) Control piston

3. Install the shaft into the roller bearing with a press and the roller bearing removal and installation jig.



(26) Roller bearing
(27) Shaft

(Q) Roller bearing removal and installation jig

4. Install the shaft.

■ NOTE

- Apply hydraulic oil to the outer circumference of the roller bearing.



(26) Roller bearing

(27) Shaft

5. Install the swash plate.

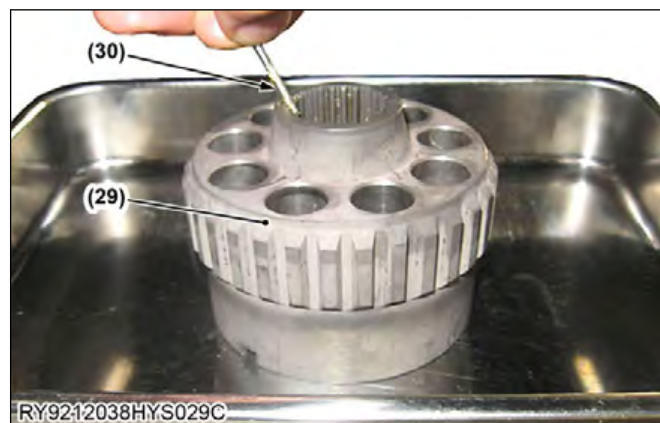


(28) Swash plate

6. Install the 3 pins into the cylinder block.

■ NOTE

- Grease the 3 pins.



(29) Cylinder block

(30) Pin ×3

7. Install the retainer holder into the cylinder block.



(31) Retainer holder

8. Install the 9 pistons and the retainer plate into the cylinder block.

■ NOTE

- Apply hydraulic oil to the pistons.



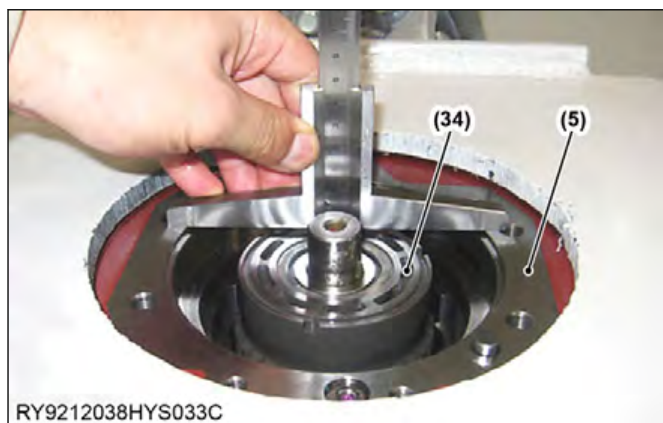
(32) Piston ×9 (33) Retainer plate

9. Turn the working platform 90°. Install the cylinder block kit.

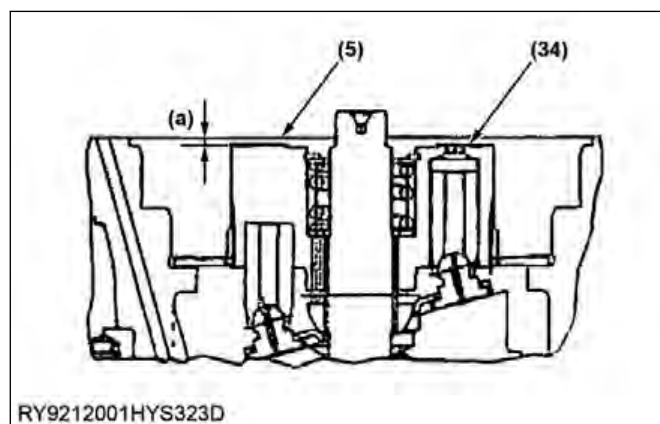


(34) Cylinder block kit

10. Turn the working platform 90°. Measure the clearance between the housing and the cylinder block kit with a depth gauge.



RY9212038HYS033C



RY9212001HYS323D

(5) Housing (a) Clearance
(34) Cylinder block kit

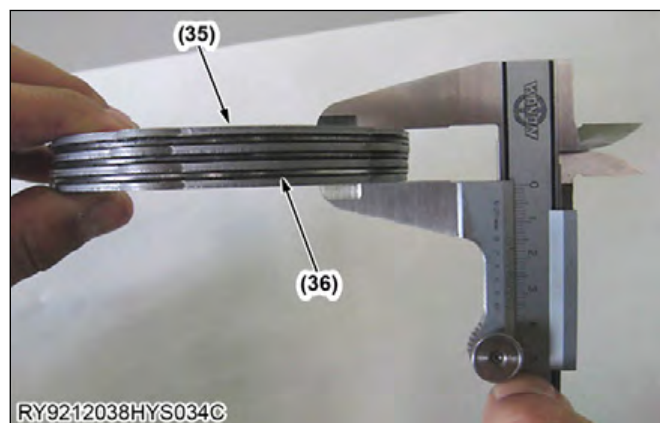
Service specification

(a) Clearance	More than 1.0 mm More than 0.04 in.
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11. Measure the thickness of the 4 separate plates and the 3 friction plates.

NOTE

- If the total thickness is less than 13.5 mm (0.53 in.), replace the plates.



(35) Separate plate ×4

(36) Friction plate ×3

Service specification

Thickness	Separate plate	2.0 mm 0.08 in.
	Friction plate	2.0 mm 0.08 in.
	Total	14 mm 0.55 in.

12. Install the 4 separate plates and the 3 friction plates.

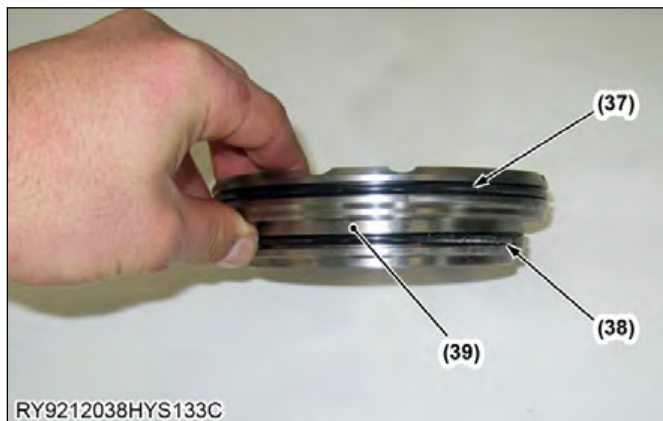


(35) Separate plate ×4 (36) Friction plate ×3

13. Install the 2 O-rings onto the brake piston.

■ NOTE

- Grease the 2 O-rings.



(37) O-ring (38) O-ring (39) Brake piston

14. Install the brake piston.

■ NOTE

- Align the pin hole with the center point between the mounting bolt hole and the oil passage hole for travel speed shift.



(39) Brake piston (R) Pin hole (S) Mounting bolt hole (T) Oil passage hole for travel speed shift

15. Install the 8 brake springs.

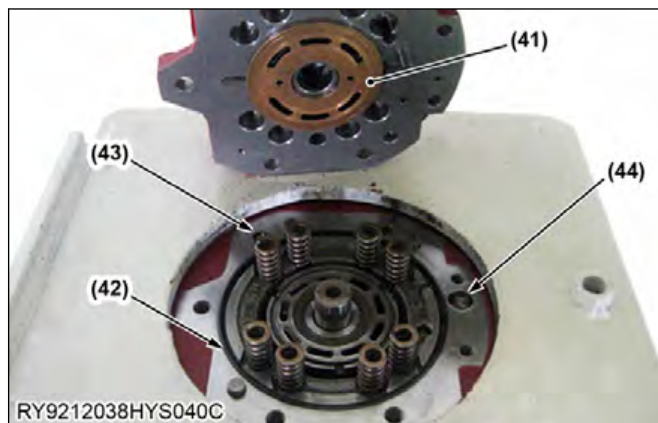


(40) Brake spring ×8

16. Install the valve plate onto the end cap. Install the 3 O-rings onto the housing.

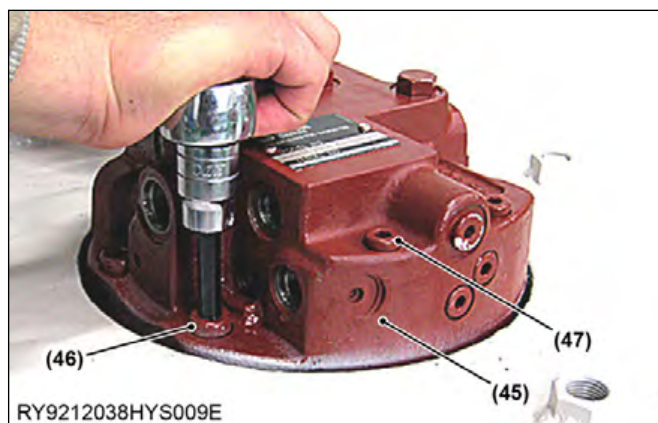
■ NOTE

- Make sure that the valve plate faces the right direction.
- Grease the 3 O-rings.



(41) Valve plate (42) O-ring (43) O-ring (44) O-ring

17. Install the end cap and tighten the 7 cap bolts.



(45) End cap (46) Cap bolt (M10 × 30) ×5 (47) Cap bolt (M8 × 70) ×2

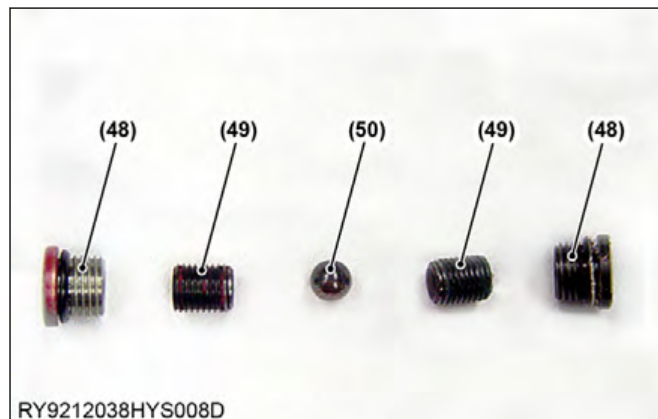
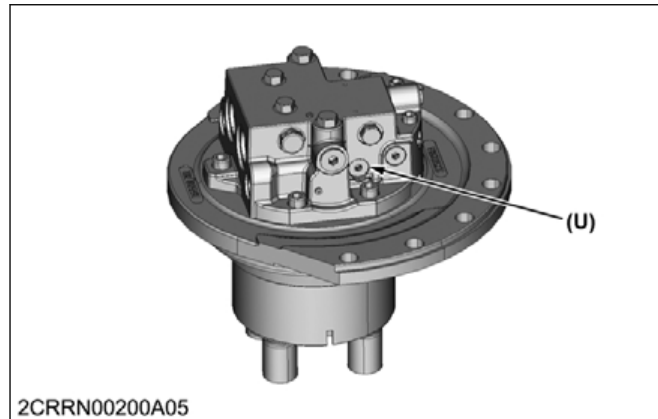
Tightening torque

(46) Cap bolt	60 N · m 6.1 kgf · m 44 lbf · ft	—
(47) Cap bolt	30 N · m 3.1 kgf · m 22 lbf · ft	—

18. Install the high pressure selector valve component.

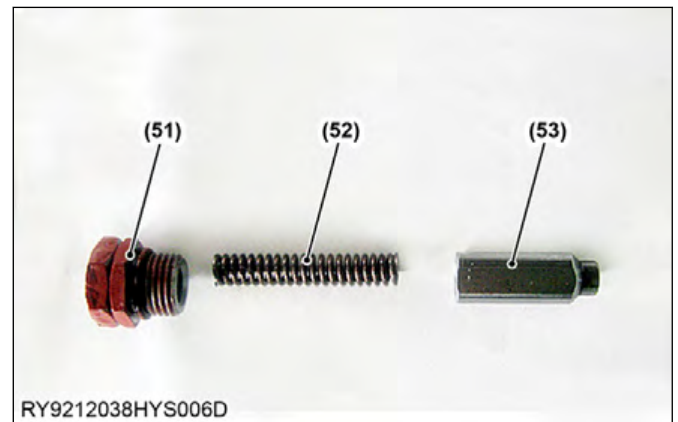
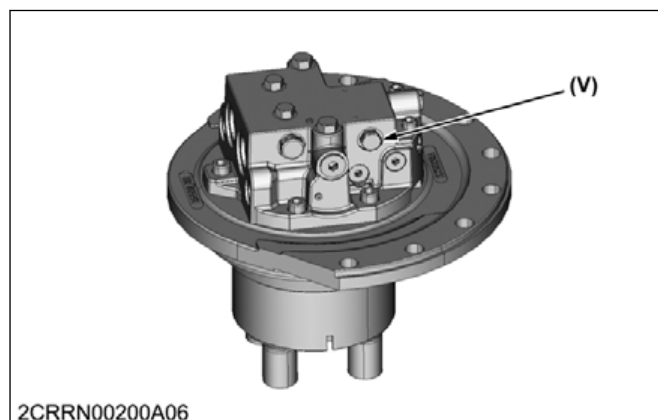
NOTE

- Apply ThreeBond® 1324 to the 2 sheet plugs.



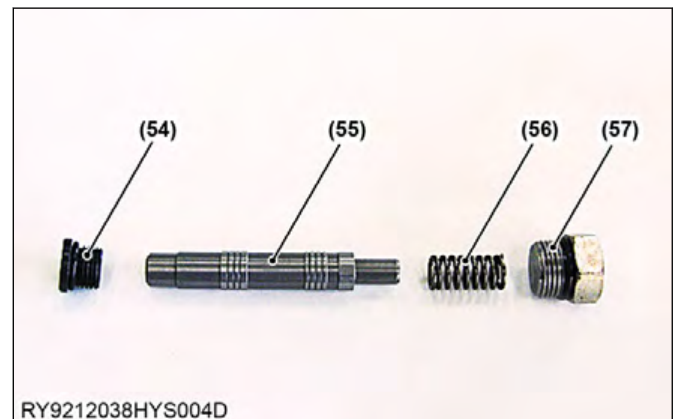
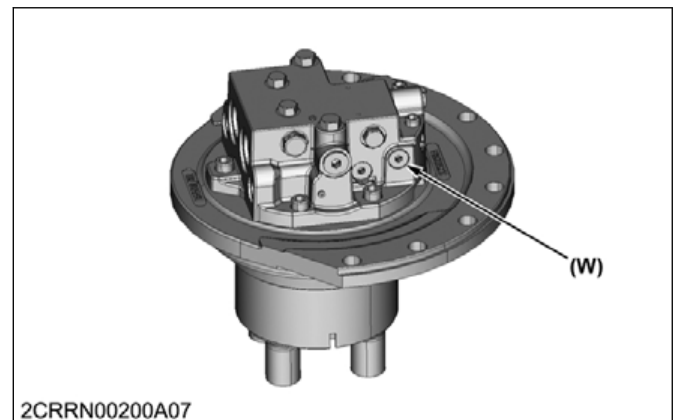
- (48) Plug with O-ring ×2
(49) Sheet plug ×2
(50) Ball
(U) High pressure selector valve component

19. Install the flushing relief valve component.



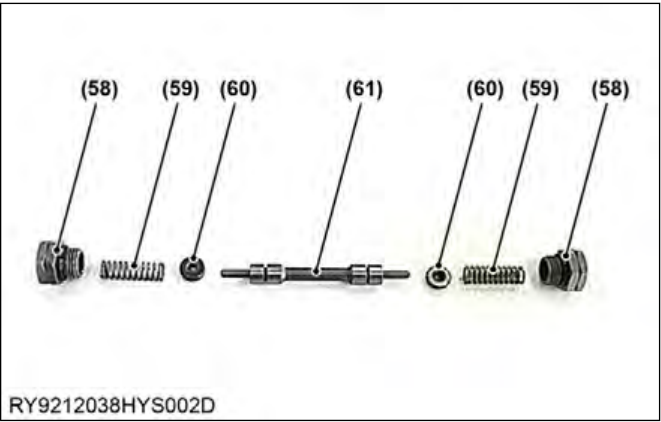
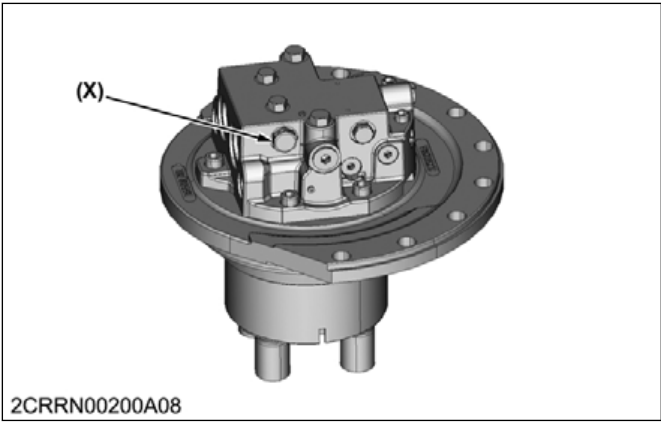
- (51) Plug with O-ring
(52) Spring
(53) Poppet
(V) Flushing relief valve component

20. Install the travel speed shift valve component.



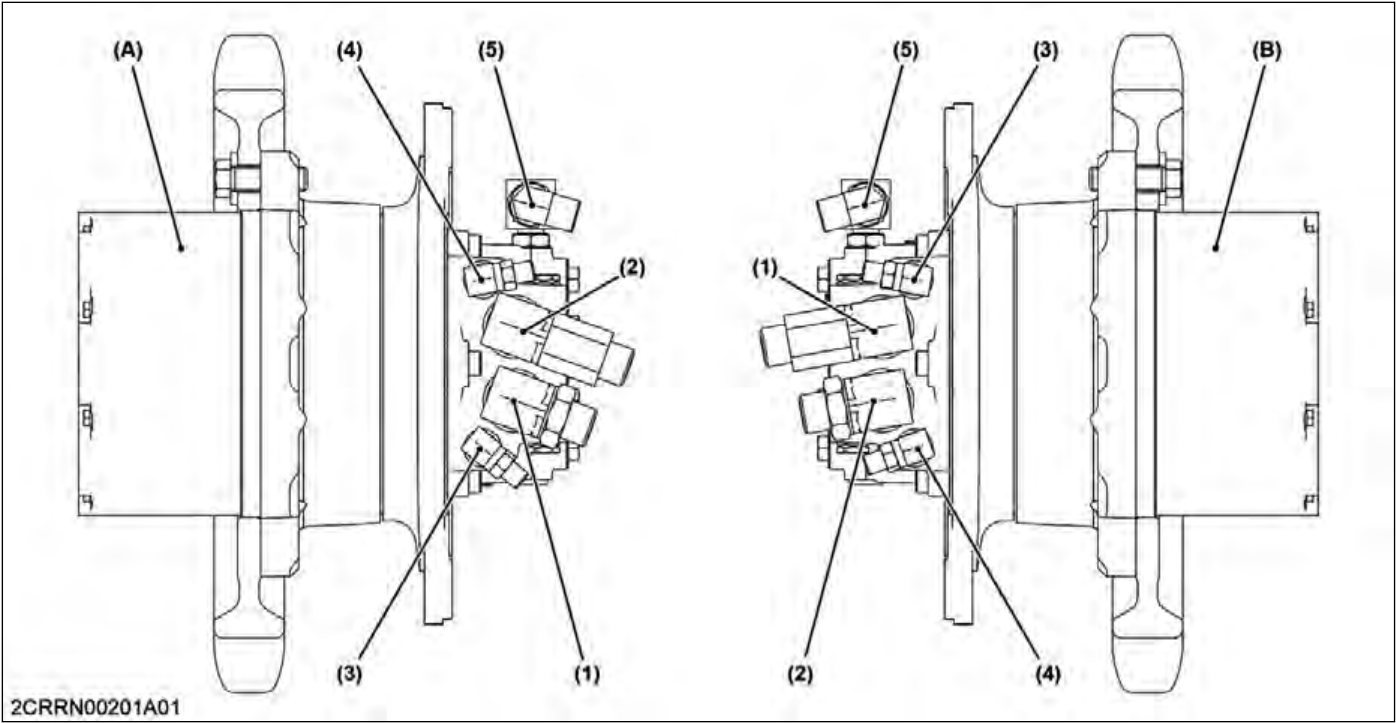
- (54) Plug with O-ring
(55) Spool
(56) Spring
(57) Plug with O-ring
(W) Travel speed shift valve component

21. Install the flushing valve component.



- (58) Plug with O-ring ×2
- (59) Spring ×2
- (60) Guide ×2
- (61) Spool
- (X) Flushing valve component

4.4.5 Installing adapters for the HST motor



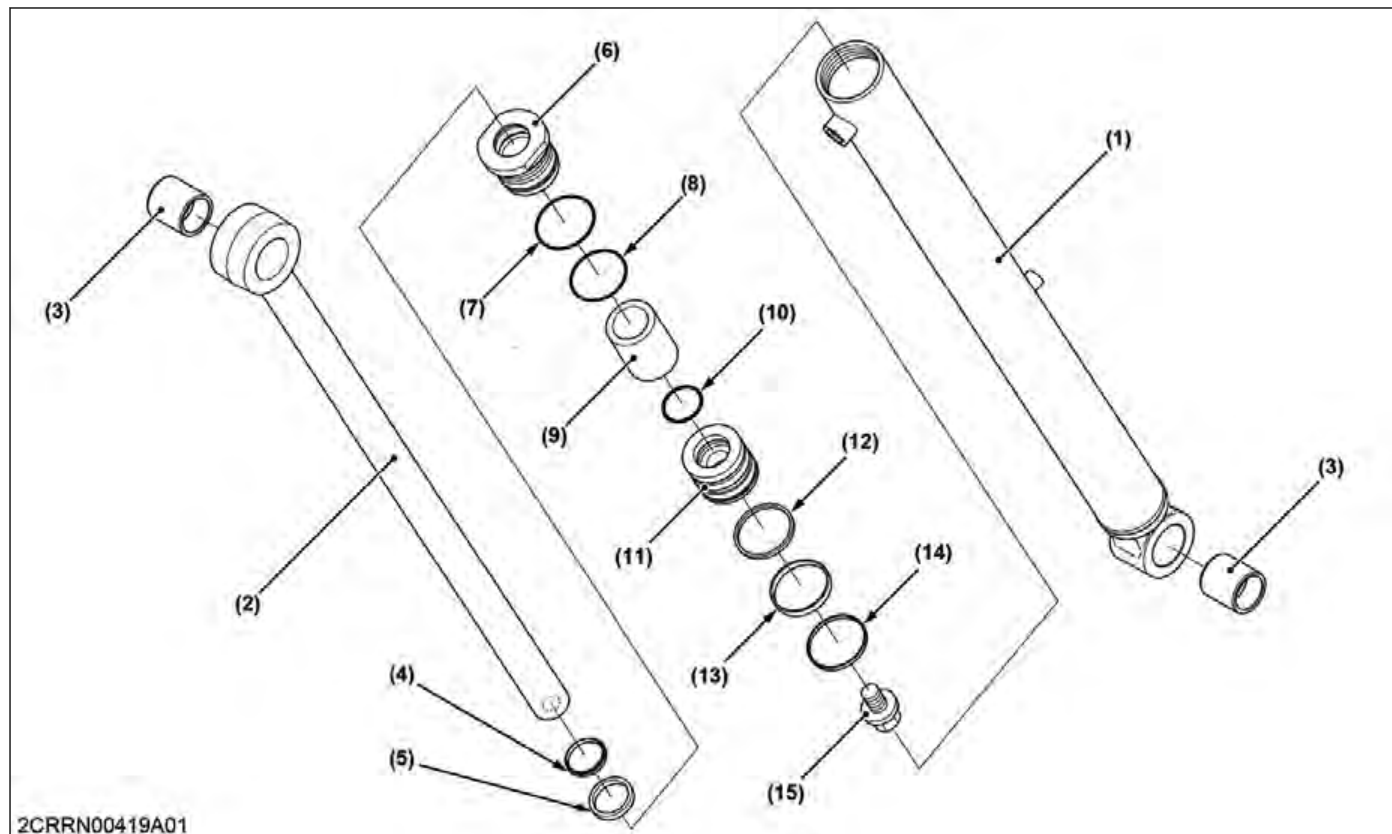
(A) HST motor RH (B) HST motor LH

No.	Port	Adapter size	Adapter angles	
			HST motor LH	HST motor RH
(1)	A	G3/4-1-14UN	20°	10°
(2)	B	G3/4-1-14UN	20°	10°
(3)	P2	G1/4-G1/4	40°	10°
(4)	Pb	G1/4-G1/4	10°	20°
(5)	Dr	G1/2-G1/2	15°	15°

4.5 Hydraulic cylinder

4.5.1 Cylinder components

4.5.1.1 Lift arm cylinder components



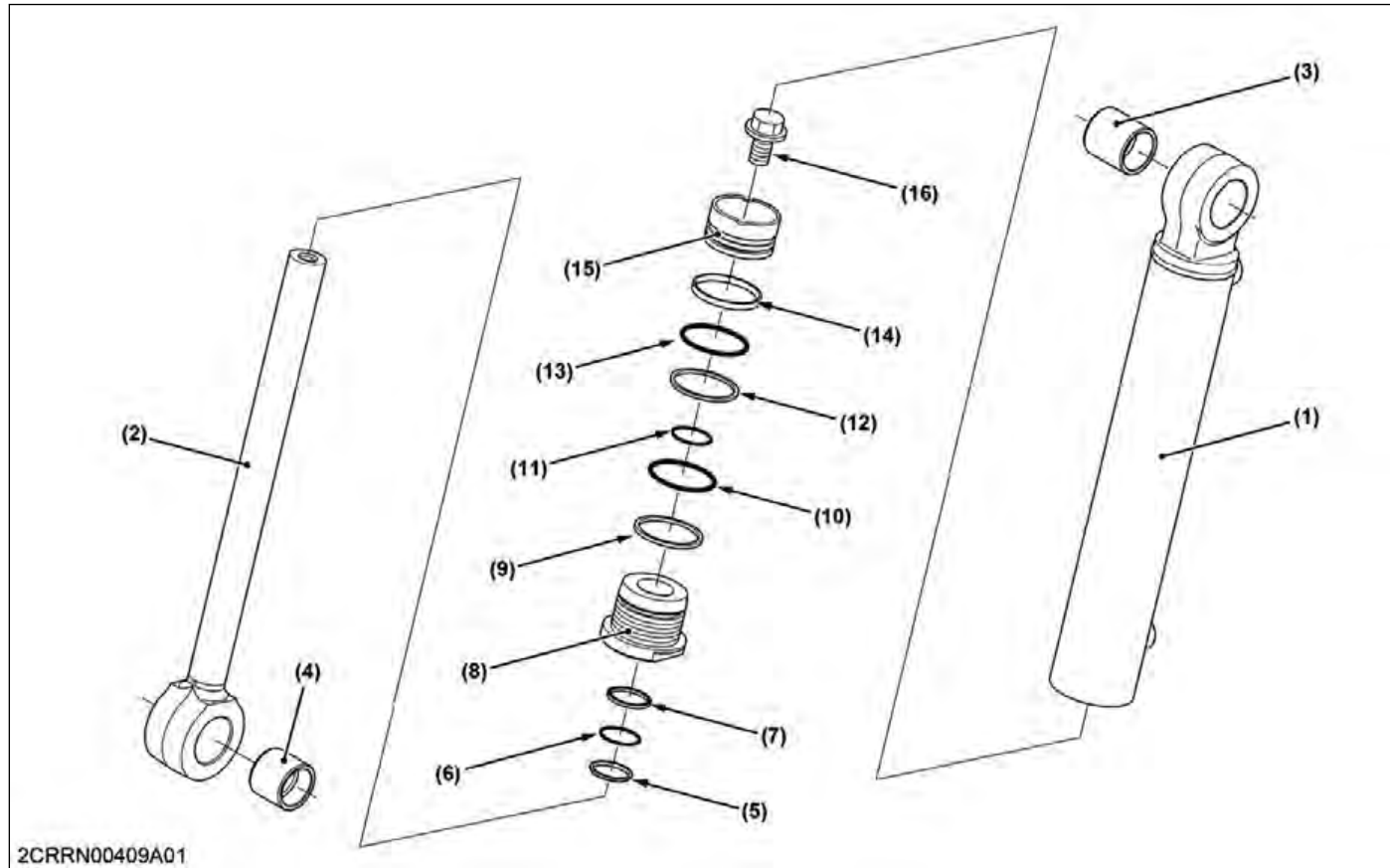
(1) Cylinder tube
(2) Cylinder rod
(3) Bushing
(4) Wiper ring

(5) Seal ring
(6) Cylinder head
(7) Back-up ring
(8) O-ring

(9) Spacer
(10) O-ring
(11) Piston
(12) Seal ring

(13) Slide ring
(14) Cushioning ring
(15) Bolt

4.5.1.2 Bucket cylinder components



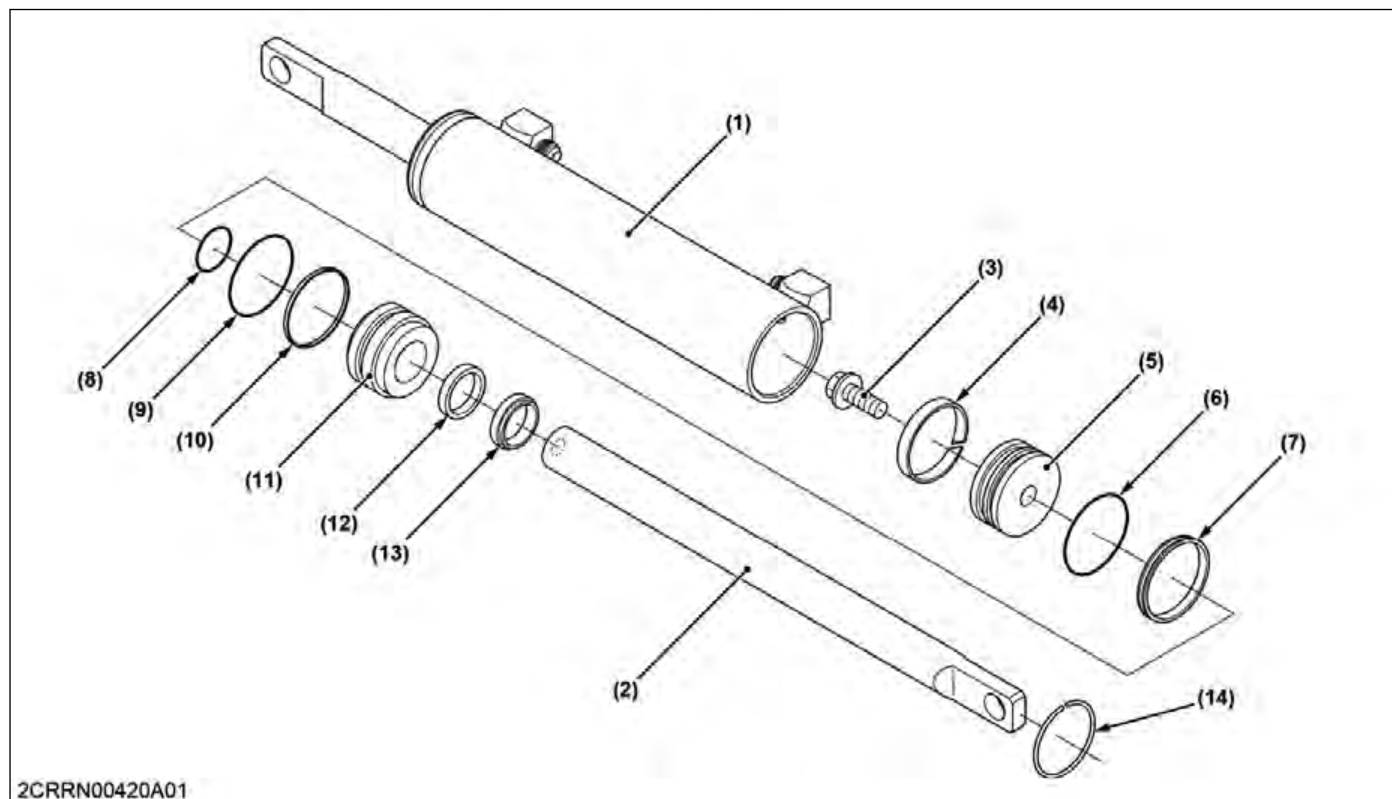
- (1) Cylinder tube
- (2) Cylinder rod
- (3) Bushing
- (4) Bushing

- (5) Dust seal
- (6) Anti extrusion ring
- (7) U-ring
- (8) Cylinder head

- (9) Back-up ring
- (10) O-ring
- (11) O-ring
- (12) Seal ring

- (13) O-ring
- (14) Slide ring
- (15) Piston
- (16) Bolt

4.5.1.3 Hydraulic quick hitch cylinder components



2CRRN00420A01

- (1) Cylinder tube
- (2) Cylinder rod
- (3) Bolt
- (4) Slide ring

- (5) Piston
- (6) O-ring
- (7) Seal ring
- (8) O-ring

- (9) O-ring
- (10) Back-up ring
- (11) Cylinder head
- (12) Seal ring

- (13) Wiper ring
- (14) Retainer ring

4.5.2 Disassembling the hydraulic cylinder

4.5.2.1 Disassembling the hydraulic quick hitch cylinder

■ IMPORTANT

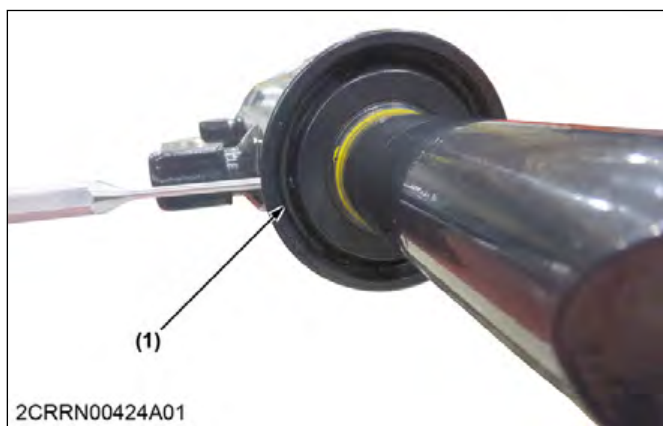
- Work at clean work space with clean tools and lubricants when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.

Disassembling the cylinder rod

1. Fasten the cylinder bottom in a vice. Support the cylinder bottom with a stand.
2. Remove the plugs.



3. Remove the circlip by pushing from the hole with a thin stick.

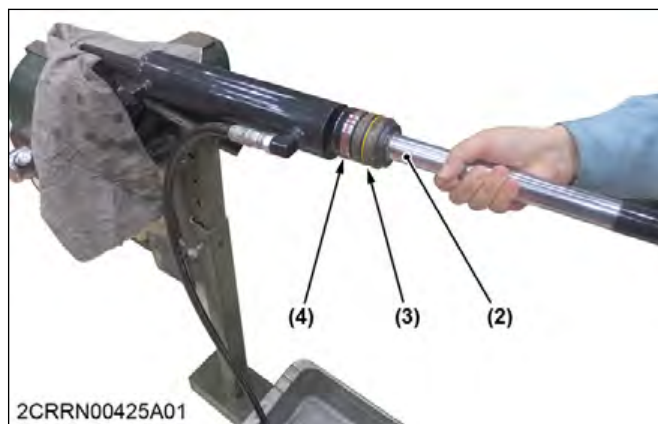


(1) Circlip

4. Remove the cylinder rod, the cylinder head, and the piston.

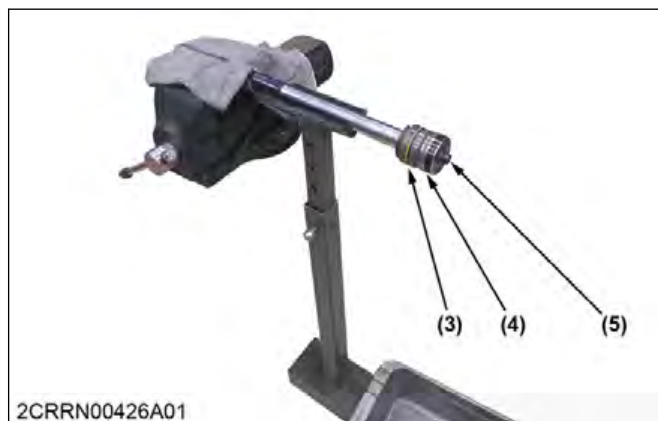
■ NOTE

- Put an oil pan under the cylinder head.
- Install a hose to drain the hydraulic oil.



(2) Cylinder rod
(3) Cylinder head
(4) Piston

5. Fasten the cylinder rod in a vice. Support the cylinder rod with a stand.

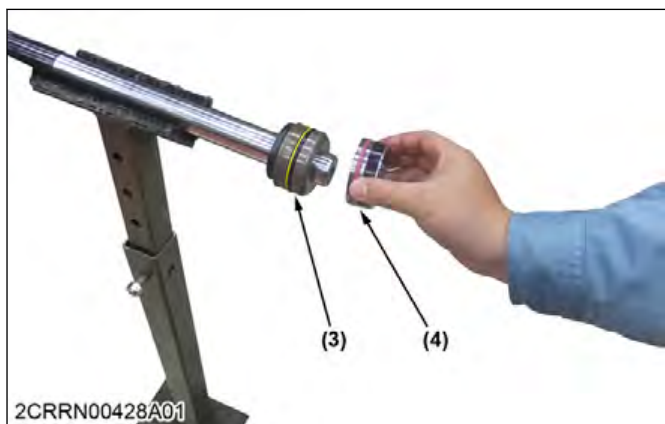


(3) Cylinder head
(4) Piston
(5) Bolt (M11 × 30)

6. Loosen the bolt with a socket wrench.

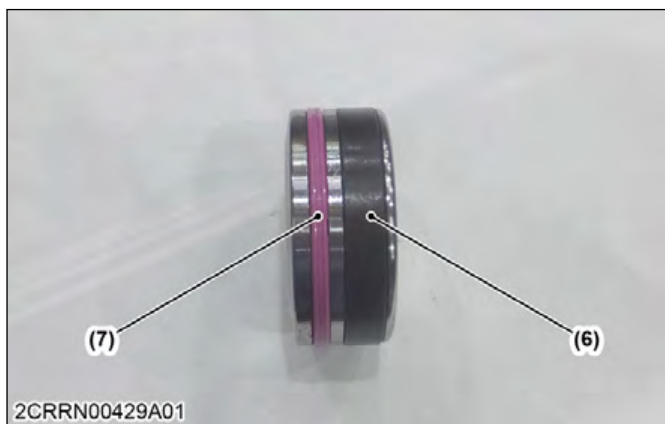


7. Remove the piston and the cylinder head.



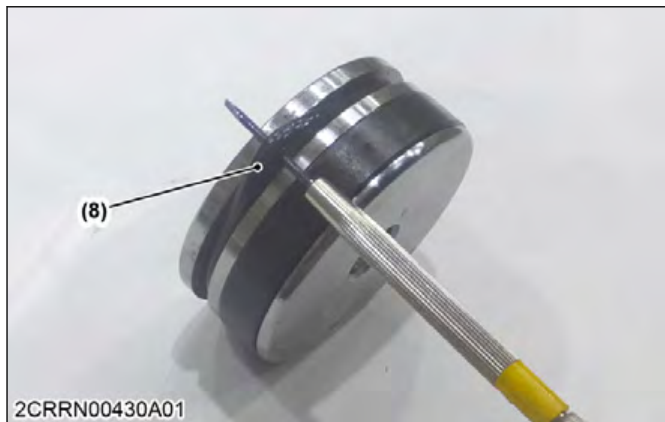
(3) Cylinder head (4) Piston

8. Remove the slide ring and seal ring.



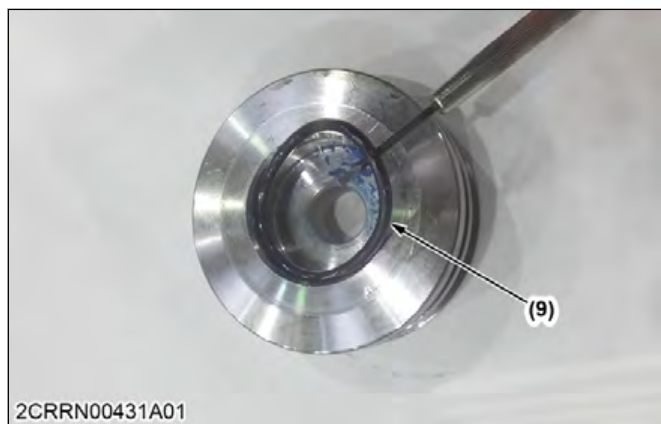
(6) Slide ring (7) Seal ring

9. Remove the O-ring with a flat tip screwdriver.



(8) O-ring

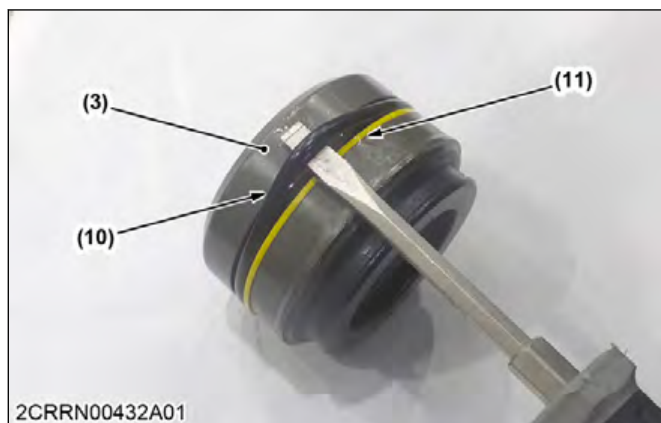
10. Remove the O-ring with a flat tip screwdriver.



(9) O-ring

Disassembling the cylinder head

1. Remove the O-ring and back-up ring with a flat tip screwdriver.



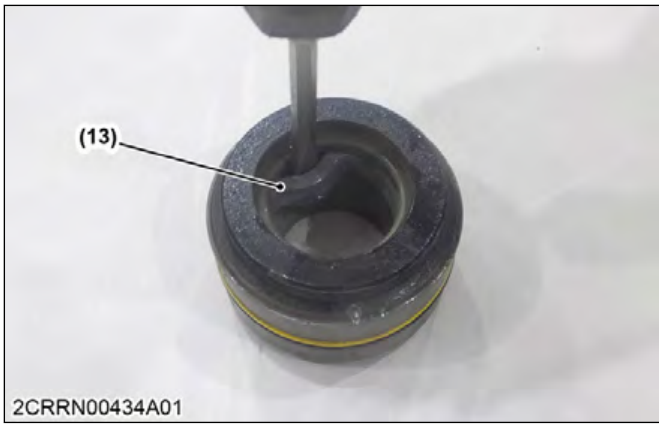
(3) Cylinder head (10) O-ring (11) Back-up ring

2. Remove the dust seal with a flat tip screwdriver.



(12) Dust seal

3. Remove the U-ring with a flat tip screwdriver.



(13) U-ring

4.5.2.2 Disassembling the bucket and lift arm cylinder

■ IMPORTANT

- Work at clean work space with clean tools and lubricants when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.

Disassembling the cylinder rod

1. Drain the hydraulic oil.
2. Fasten the bottom side of the cylinder in a vice. Support the cylinder with a stand.



3. Loosen the cylinder head.

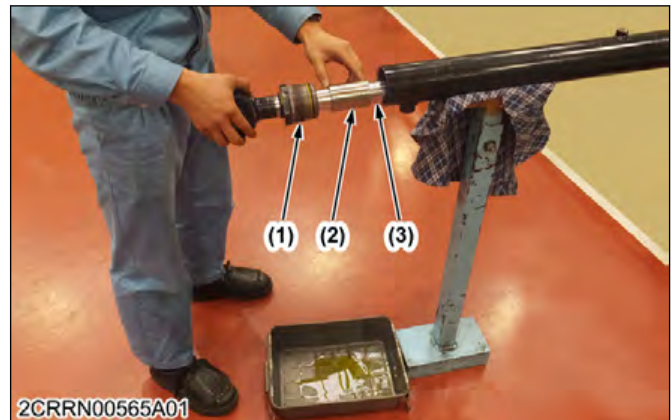


(1) Cylinder head

4. Remove the piston rod, spacer, and cylinder head.

■ NOTE

- Remove the plugs before pulling out the piston rod and cylinder head.
- Put an oil pan under the cylinder head.
- There is the spacer only in the lift arm cylinder.



(1) Cylinder head

(2) Spacer

(3) Piston rod

5. Fasten the piston rod assembly in a vice. Support the piston rod assembly with a stand.

■ IMPORTANT

- Do not damage the rod. Put a cushion under the rod for support.

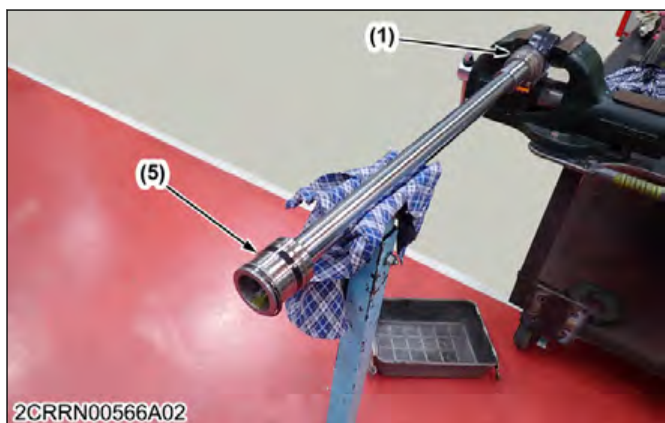


6. Loosen the bolt with a socket wrench.



(4) Bolt (M20 × 55)

7. Remove the piston and cylinder head.



(1) Cylinder head

(5) Piston

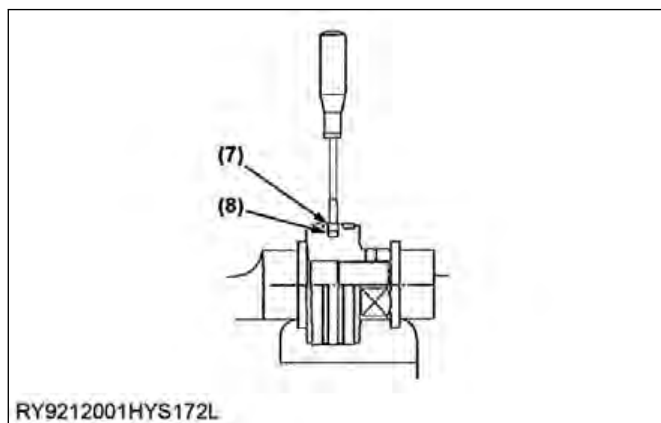
8. Remove the slide ring.



(6) Slide ring

9. Remove the seal ring by hitting a flat tip screwdriver with a hammer.

10. Remove the O-ring with a flat tip screwdriver.



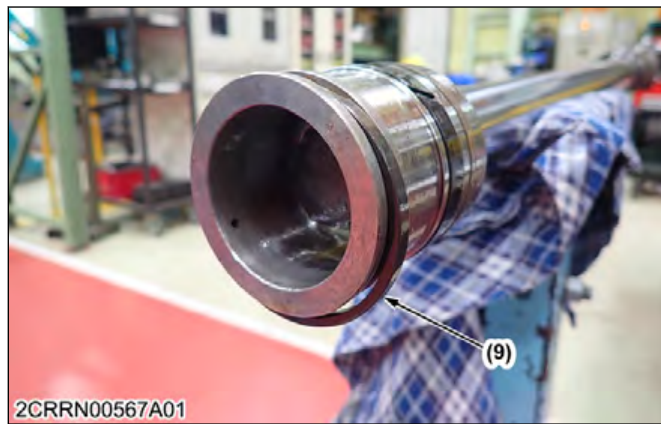
(7) Seal ring

(8) O-ring

11. Remove the cushioning ring.

NOTE

- Removal of the cushioning ring is needed only for the lift arm cylinder assembly.



(9) Cushioning ring

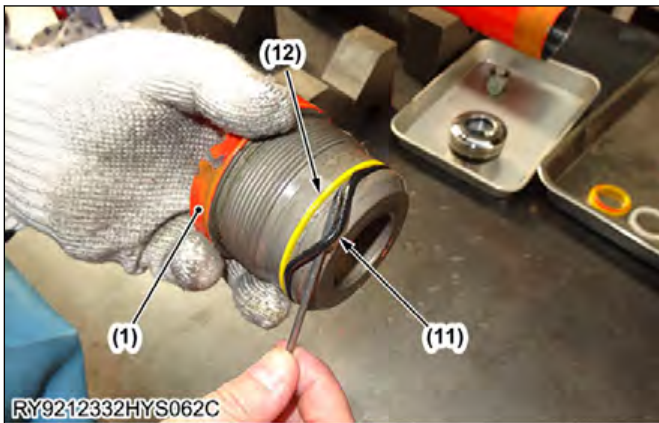
12. Remove the O-ring with a flat tip screwdriver.



(10) O-ring

Disassembling the cylinder head

1. Remove the O-ring and back-up ring with a flat tip screwdriver.



(1) Cylinder head (12) Back-up ring
(11) O-ring

2. Remove the dust seal with a flat tip screwdriver.



(13) Dust seal

3. Remove the U-ring with a flat tip screwdriver.



(14) U-ring

4. Remove the back-up ring.



(15) Back-up ring

4.5.3 Assembling the hydraulic cylinder**4.5.3.1 Assembling the hydraulic quick hitch cylinder****■ IMPORTANT**

- Do not reuse removed O-rings, oil seals, seal ring, and the dust seal for assembly to avoid oil leakage.
- Work at clean work space with clean tools and lubricants when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Apply lubricant or grease to every seal to avoid damage when assembling.

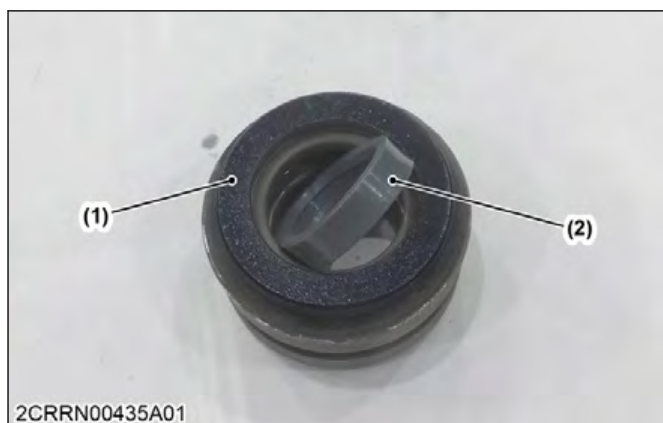
Assembling the cylinder head

1. Install the U-ring.

■ NOTE

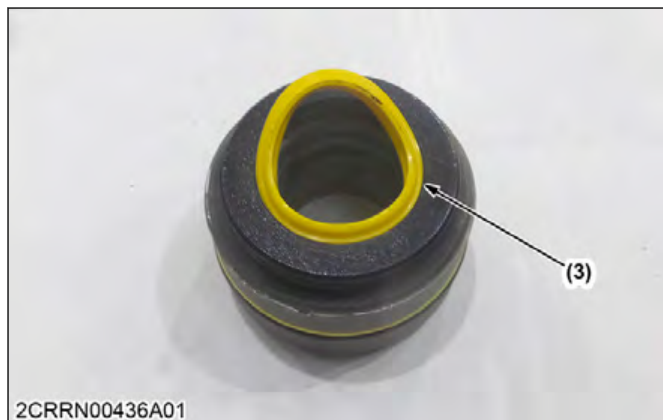
- Apply hydraulic oil to the U-ring.

- Make sure that the U-ring faces the correct direction.



(1) Cylinder head (2) U-ring

2. Install the dust seal.



(3) Dust seal

3. Install the O-ring and the back-up ring.

■ NOTE

- Apply hydraulic oil to the O-ring and the back-up ring.



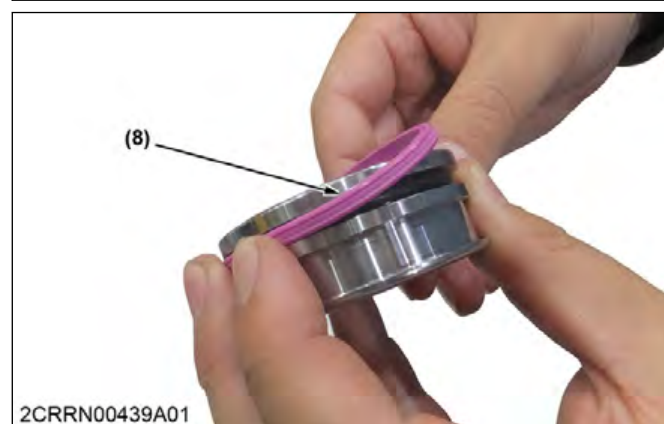
(4) Back-up ring (5) O-ring

Assembling the cylinder rod

1. Install the seal ring to the piston.

■ NOTE

- Apply hydraulic oil to the seal ring.



(6) Piston (7) O-ring (8) Seal ring

2. Install the O-ring.

■ NOTE

- Apply hydraulic oil to the O-ring.

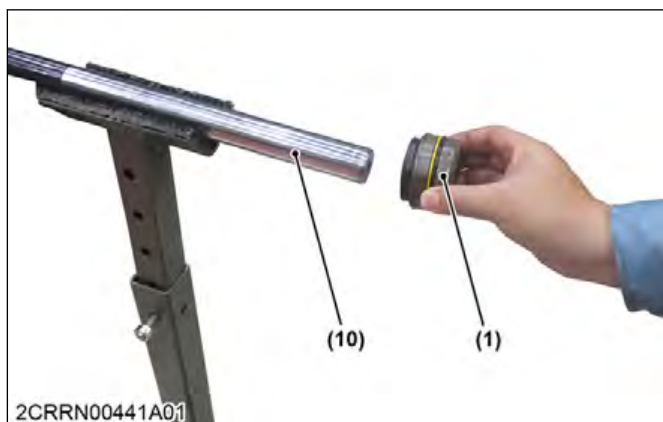


(9) O-ring

3. Fasten the cylinder rod in a vice. Support the cylinder rod with a stand.
4. Install the cylinder head into the piston rod slowly.

NOTE

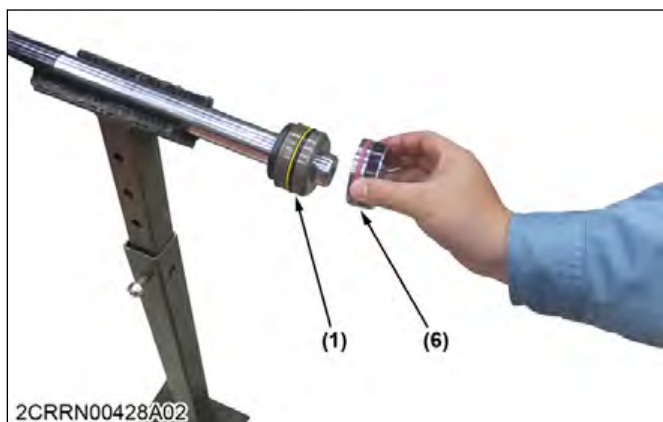
- Apply hydraulic oil to the cylinder head (seal ring and O-ring).
- Do not damage the dust seal or U-ring.



(1) Cylinder head

(10) Piston rod

5. Install the piston to the rod.



(1) Cylinder head

(6) Piston

6. Tighten the bolt.

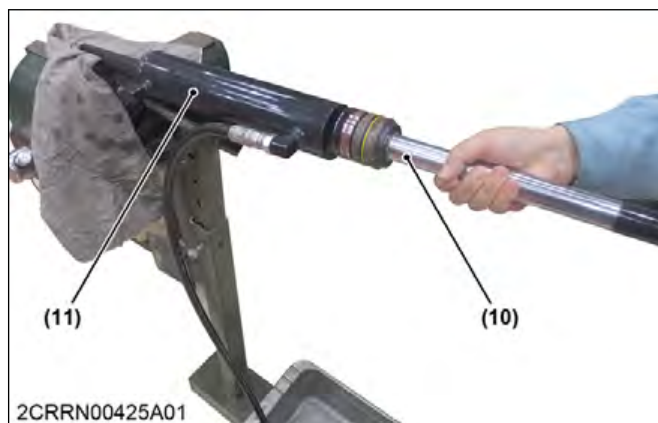
**Tightening torque**

Bolt	90 N · m 9.2 kgf · m 66 lbf · ft	Thread lock (Loctite 263)
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7. Fasten the cylinder bottom in a vice. Support the cylinder bottom with a stand.
8. Install the piston rod to the cylinder tube.

NOTE

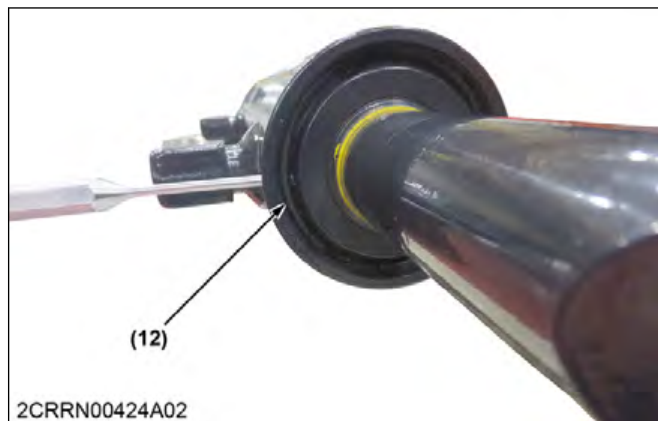
- Apply hydraulic oil to the piston rod.



(10) Piston rod

(11) Cylinder tube

9. Install the circlip to the cylinder tube.



(12) Circlip

4.5.3.2 Assembling the bucket and lift arm cylinder

■ IMPORTANT

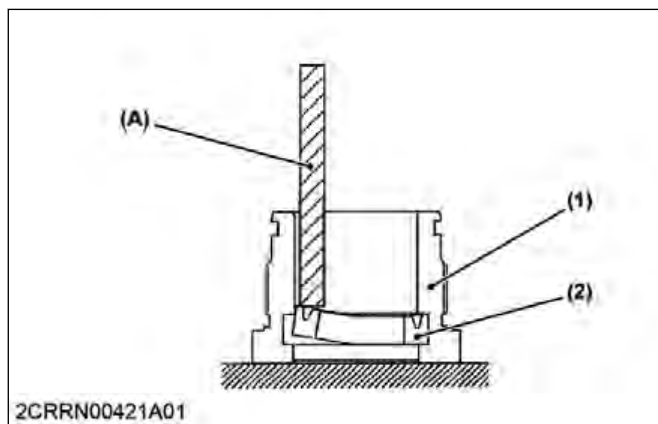
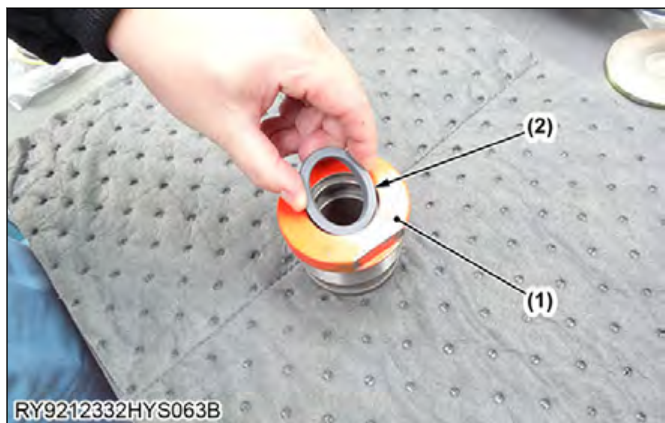
- Do not reuse removed O-rings, oil seals, seal rings, and dust seals for assembly to avoid oil leakage.
- Work at clean work space with clean tools and lubricants when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause the oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Apply lubricant or grease to every seal to avoid damage when assembling.

Assembling the cylinder head

1. Install the U-ring with the U-ring installation jig.

■ NOTE

- The U-ring installation jig is needed only for the lift arm cylinder assembly.
- Apply hydraulic oil to the U-ring.
- Make sure that the U-ring faces the correct direction.
- Before installing, put the U-ring into boiling water for 5 to 10 minutes.



- (1) Cylinder head
(2) U-ring

(A) U-ring installation jig

2. Install the back-up ring by hand.

■ NOTE

- Installation of the back-up ring is needed only for the lift arm cylinder assembly.



- (3) Back-up ring

3. Install the dust seal by hand.

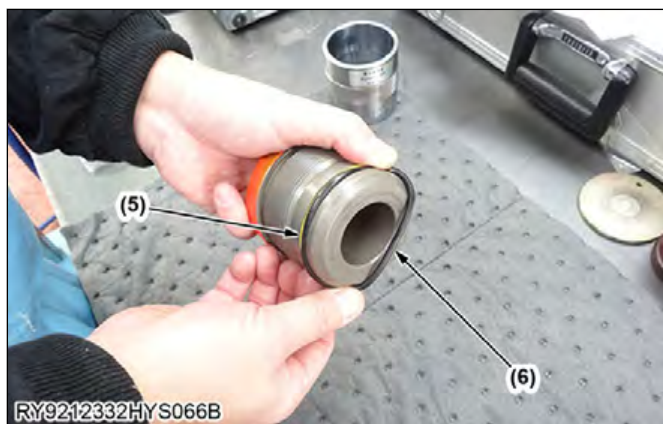


- (4) Dust seal

4. Install the O-ring and back-up ring.

■ NOTE

- Apply hydraulic oil to the O-ring and back-up ring.



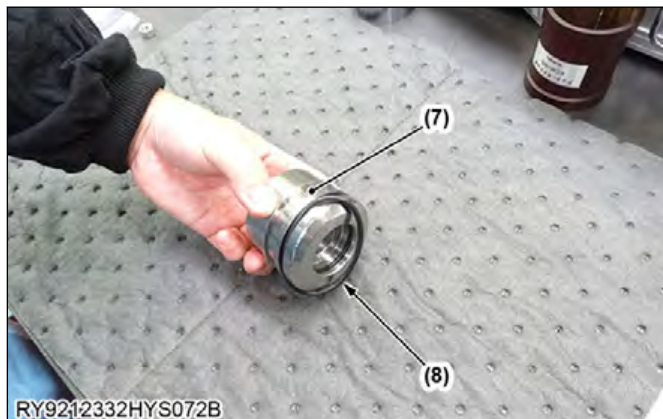
(5) Back-up ring (6) O-ring

Assembling the cylinder rod

1. Install the O-ring to the piston.

NOTE

- Apply hydraulic oil to the O-ring.



(7) Piston (8) O-ring

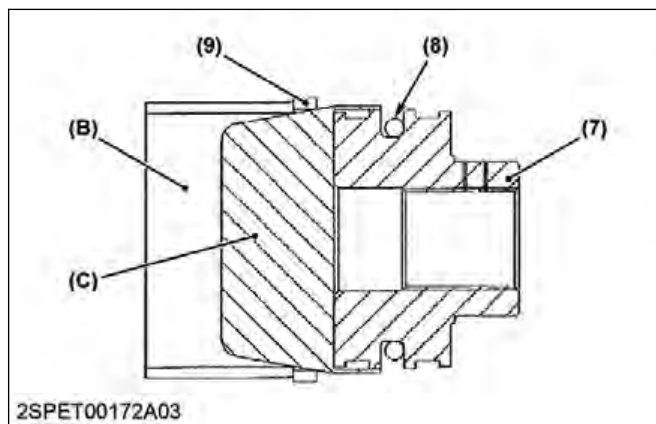
2. Install the seal ring onto the O-ring with the seal ring installation jigs.

NOTE

- Apply hydraulic oil to the seal ring.
- The seal ring installation jigs are needed only for the lift arm cylinder assembly.



RY9212001HYS082J



2SPET00172A03

(7) Piston (8) O-ring (9) Seal ring
(B) Seal ring installation jig 1
(C) Seal ring installation jig 2

3. After installing the seal ring, correct the position of the seal ring with the seal ring correction jig.

NOTE

- The seal ring correction jig is needed only for the lift arm cylinder assembly.



RY9212001HYS083C

(D) Seal ring correction jig

4. Install the slide ring to the piston.



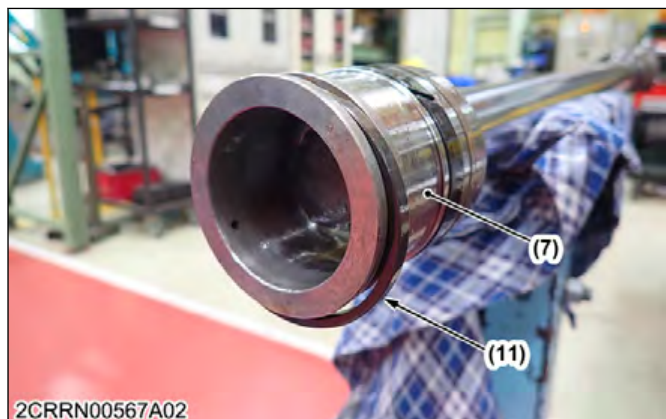
RY9212332HYS070B

(7) Piston (10) Slide ring

5. Install the cushioning ring.

■ NOTE

- Installation of the cushioning ring is needed only for the lift arm cylinder assembly.

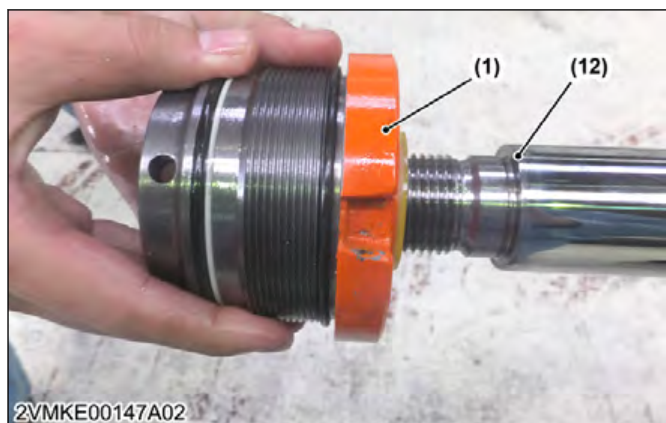


(7) Piston (11) Cushioning ring

6. Fasten the bottom side of the cylinder in a vice.
7. Install the cylinder head into the piston rod slowly.

■ NOTE

- Apply hydraulic oil to the cylinder head (seal ring and O-ring).
- Do not damage the dust seal or U-ring.

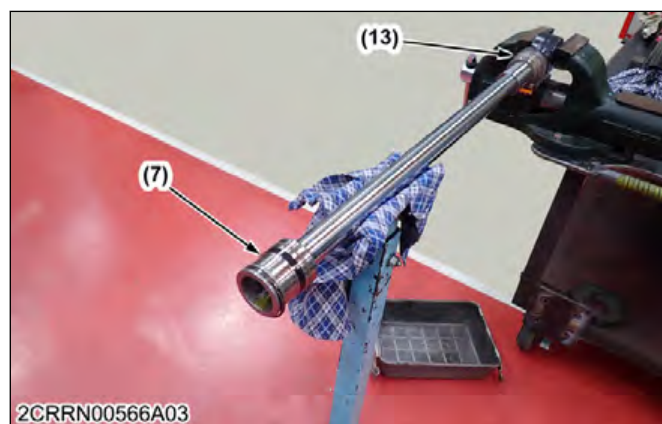


(1) Cylinder head (12) Piston rod

8. Install the piston and spacer to the rod.

■ NOTE

- Installation of the spacer is needed only for the lift arm cylinder assembly.



(7) Piston (13) Spacer

9. Tighten the bolt.



(14) Bolt (M20 × 55)

Tightening torque

Arm	(14) Bolt	490 to 510 N · m 50.0 to 52.0 kgf · m 362 to 376 lbf · ft	Thread lock (Loctite 263)
Bucket		480 to 520 N · m 49.0 to 53.0 kgf · m 354 to 383 lbf · ft	Thread lock (Loctite 263)

10. Fasten the bottom side of cylinder in a vice.
11. Install the piston rod to the cylinder tube.

■ NOTE

- Apply hydraulic oil to the piston rod.



(12) Piston rod

(15) Cylinder tube

12. Tighten the cylinder head.



(1) Cylinder head

Tightening torque

Arm	(1) Cylinder head	690 to 710 N·m 70.4 to 72.3 kgf·m 509 to 523 lbf·ft	Thread lock (Loctite 263)
Bucket		730 to 770 N·m 74.5 to 78.5 kgf·m 539 to 567 lbf·ft	Thread lock (Loctite 263)

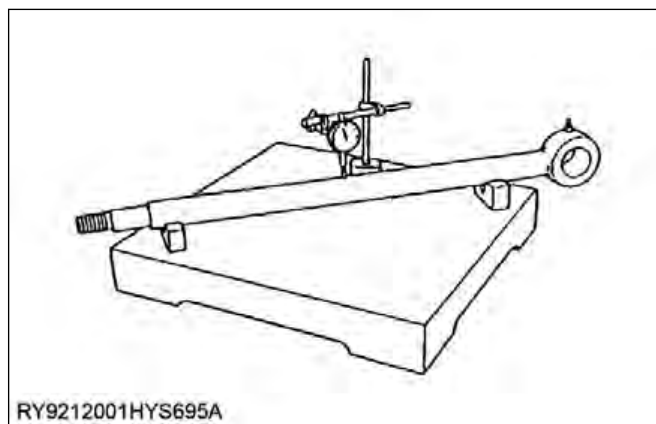
4.5.4 Measuring the hydraulic cylinder

4.5.4.1 Measuring hydraulic cylinder bend

- Put the cylinder rod on V-blocks.
- Set a dial gauge on the center of the rod.
- Rotate the cylinder rod slowly to measure the bend.

NOTE

- The bend value of the rod can be acquired by halving the measured value.
- Replace the rod if the bend value is exceeding the service limit.



Service specification

Bend	Less than 0.05 mm Less than 0.002 in.
------	--

Service limit

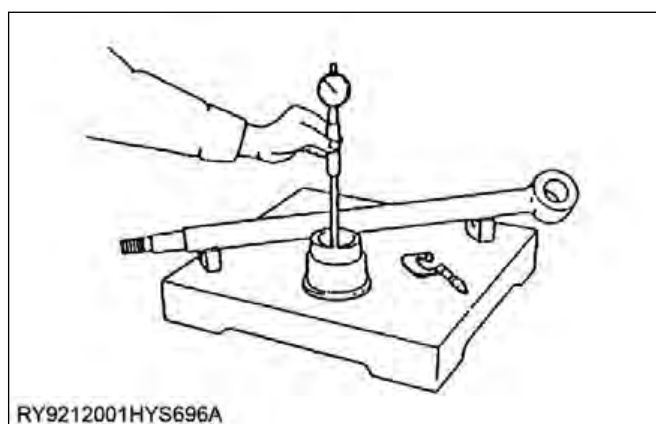
Bend	0.5 mm 0.02 in.
------	--------------------

4.5.4.2 Measuring clearance between rod and head of the hydraulic cylinders

- Measure the external diameter of the cylinder rod and internal diameter of the cylinder head (inside of bushings) to calculate the clearance.

NOTE

- Replace the cylinder rod if the clearance value is exceeding the service limit.



Service specifications

Clearance	Lift arm cylinder	Less than 0.25 mm Less than 0.01 in.
	Bucket cylinder	
	Quick hitch cylinder	

Service limits

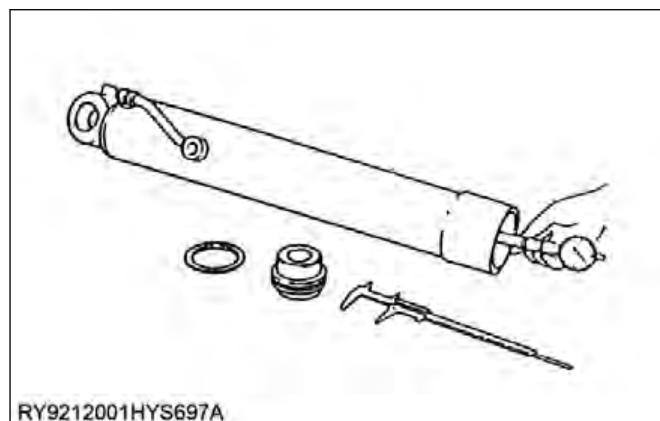
Clearance	Lift arm cylinder	0.4 mm 0.016 in.
	Bucket cylinder	
	Quick hitch cylinder	

4.5.4.3 Measuring clearance between the tube and wear ring of the hydraulic cylinders

1. Measure the internal diameter of the cylinder tube and the external diameter of the cylinder wear ring to calculate the clearance between them.

NOTE

- Replace the tube if the clearance value is exceeding the service limit.



Service specifications

Clearance	Lift arm cylinder	0.05 to 0.35 mm 0.002 to 0.014 in.
	Bucket cylinder	
	Quick hitch cylinder	

Service limits

Clearance	Lift arm cylinder	0.7 mm 0.028 in.
	Bucket cylinder	
	Quick hitch cylinder	

4.6 Pilot control valve

4.6.1 Removing and installing the pilot control valve



CAUTION

- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.
- Before disconnecting the hydraulic hoses, release the residual pressure first.

IMPORTANT

- Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

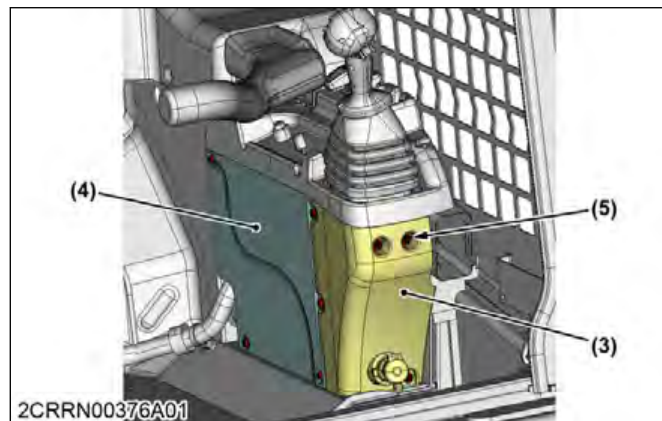
1. Park the machine on the firm and level ground.
2. Lower the front attachment and stop the engine.
3. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.

Removing

1. Remove the 8 bolts and the 2 covers.

NOTE

- Remove the A/C duct if necessary.



- | | |
|-------------------------|------------------------|
| (1) Bolt (M10 × 20) × 4 | (4) Cover |
| (2) A/C duct | (5) Bolt (M5 × 15) × 8 |
| (3) Cover | |

2. Disconnect the hydraulic hoses and wire harness from the pilot control valve LH.



(6) Pilot control valve LH

3. Remove the 3 bolts and the pilot control valve LH.



(6) Pilot control valve LH (7) Cap bolt (M5 × 30) ×3

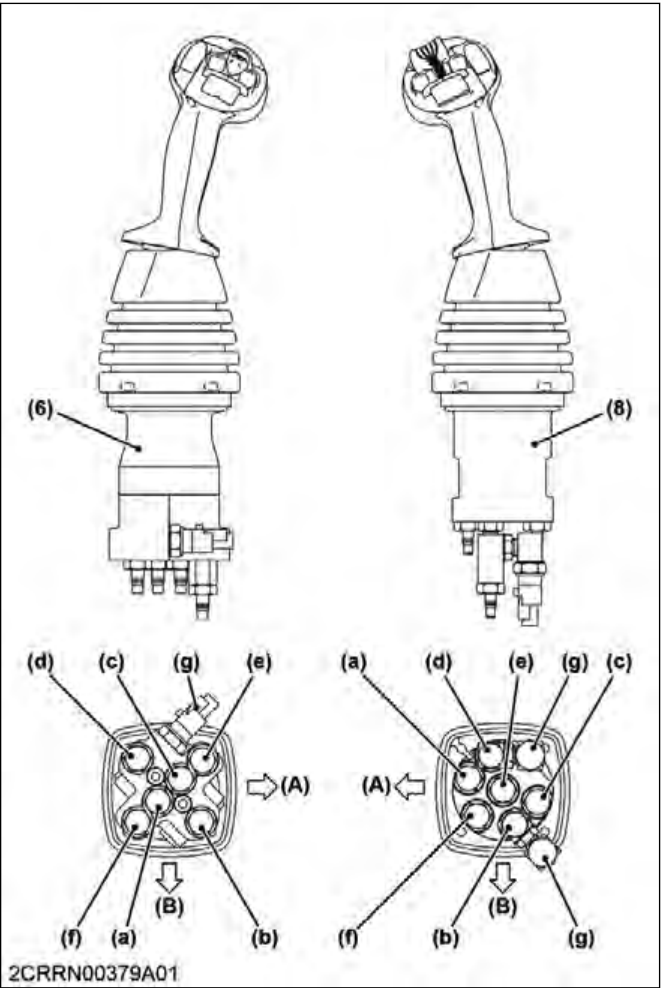
Mass

(6) Pilot control valve LH	Approximately 4.2 kg Approximately 9.3 lbs	Actual measured value
(8) Pilot control valve RH	Approximately 1.6 kg Approximately 3.5 lbs	Reference value

Installing

NOTE

- Make sure to connect the hydraulic hoses correctly.

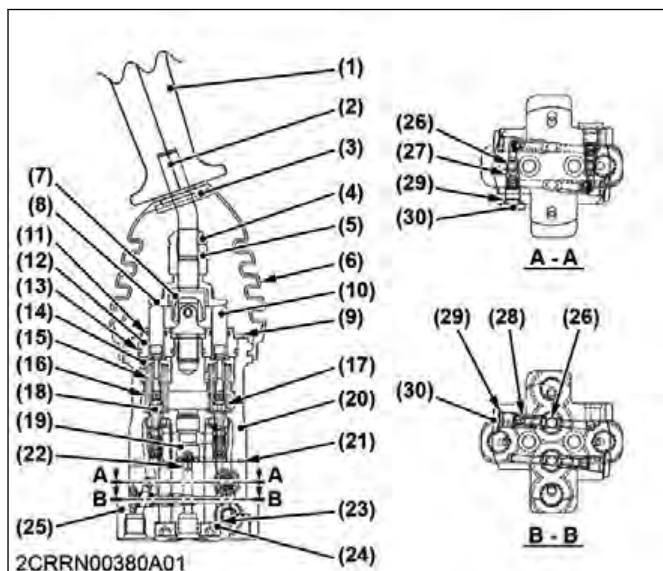


- (6) Pilot control valve LH
(8) Pilot control valve RH
(a) Port 1
(b) Port 2
(c) Port 3
(d) Port 4
(e) Port P
(f) Port T
(g) Oil pressure switch
(A) Seat side
(B) Machine front side

Tightening torque

(1) Bolt	48.1 to 55.9 N · m 4.90 to 5.70 kgf · m 35.5 to 41.2 lbf · ft	—
(7) Cap bolt	9.8 to 11.3 N · m 1.0 to 1.15 kgf · m 7.2 to 8.3 lbf · ft	—

4.6.2 Pilot control valve components



- | | |
|---------------------|---------------------------|
| (1) Handle | (16) Spring ×4 |
| (2) Lever | (17) Shim ×4 |
| (3) Washer | (18) Spool ×4 |
| (4) Locknut | (19) Bushing |
| (5) Adjusting nut | (20) Casing |
| (6) Bellows | (21) O-ring |
| (7) Universal joint | (22) Spring pin |
| (8) Disc nut | (23) Washer ×2 |
| (9) Plate | (24) Cap bolt (M8 ×65) ×2 |
| (10) Push rod ×4 | (25) Shuttle valve casing |
| (11) Seal ×4 | (26) Ball ×4 |
| (12) Plug ×4 | (27) Seat ×2 |
| (13) O-ring ×4 | (28) Seat ×2 |
| (14) Spring seat ×4 | (29) O-ring ×4 |
| (15) Spring ×4 | (30) Plug ×4 |

4.6.3 Disassembling the pilot control valve

■ IMPORTANT

- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Do not reuse removed O-rings for assembly to avoid oil leakage.

Disassembling the pressure reducing valves

1. Fasten the pilot control valve in a vice.
2. Remove the adjusting nut and the disc nut.



- (1) Adjusting nut (2) Disc nut

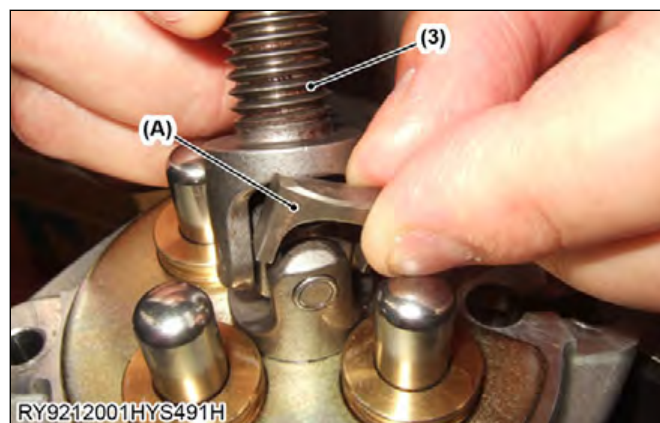
3. Put marks on the casing and the pressure reducing valves.

■ NOTE

- These marks are required when reassembling.



4. Install the universal joint tightening jig 2 to the universal joint.

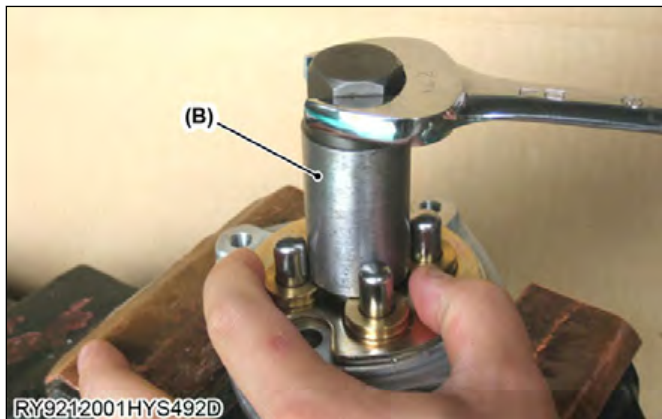


- (3) Universal joint (A) Universal joint tightening jig 2

5. Remove the universal joint with the universal joint tightening jig 1.

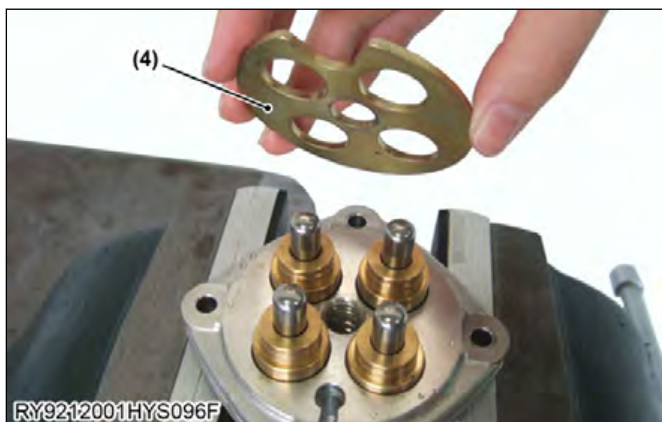
■ NOTE

- Loosen the universal joint slowly to prevent the pressure reducing valves from popping out.



(B) Universal joint tightening jig
1

6. Remove the plate.



(4) Plate

7. Remove the 4 plugs with a flat tip screwdriver.

■ NOTE

- Hold the plugs with a hand to prevent them from popping out.
- Make sure not to damage the plugs.

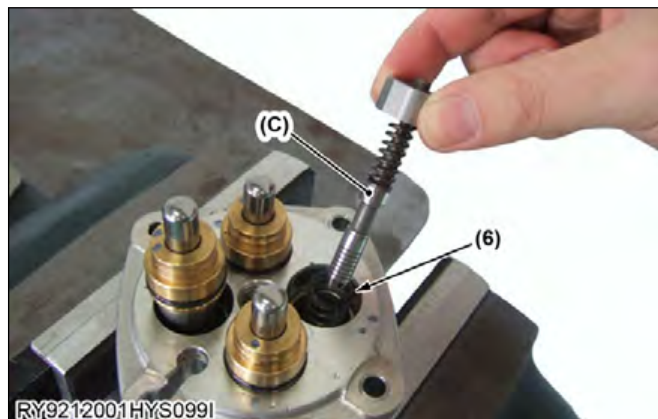


(5) Plug ×4

8. Remove the 4 pressure reducing valve assemblies and 4 springs.

■ NOTE

- Put a mark on each removed spring for reassembling.



(6) Spring ×4

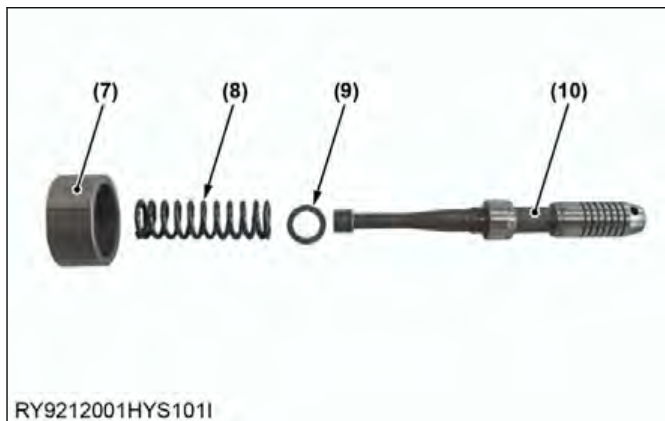
(C) Pressure reducing valve assembly ×4

Disassembling the pressure reducing valves

1. Disassemble the pressure reducing valve.

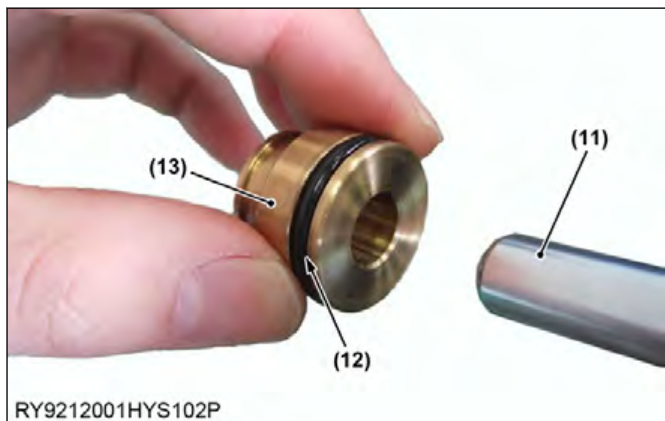
■ NOTE

- Press the spring seat to compress the spring and slide.
- Do not damage the spool.
- Do not compress the spring more than 6 mm (0.2 in.) when handling it.



- (7) Spring seat
(8) Spring
(9) Shim
(10) Spool

2. Remove the push rod from the plug.

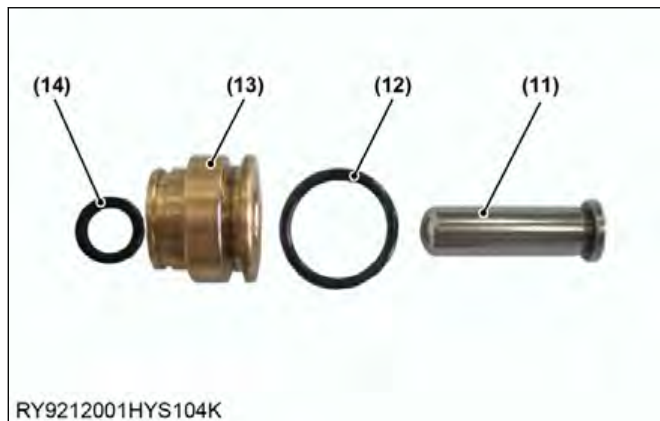
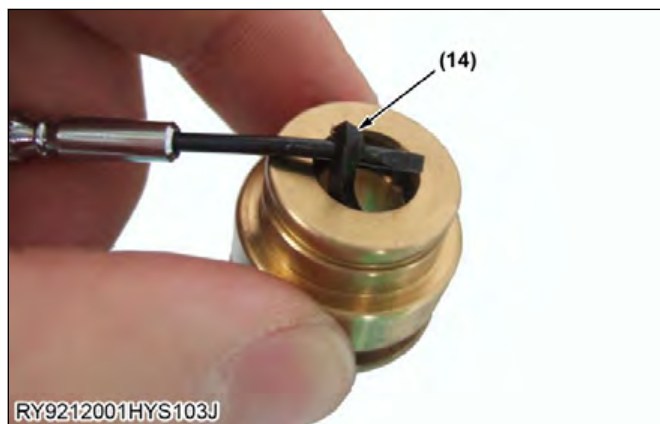


- (11) Push rod
(12) O-ring
(13) Plug

3. Remove the O-ring and seal with a flat tip screwdriver.

NOTE

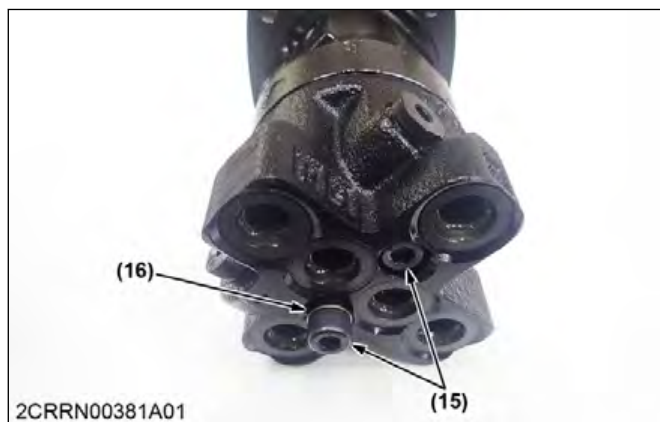
- Do not damage the plug.



- (11) Push rod
(12) O-ring
(13) Plug
(14) Seal

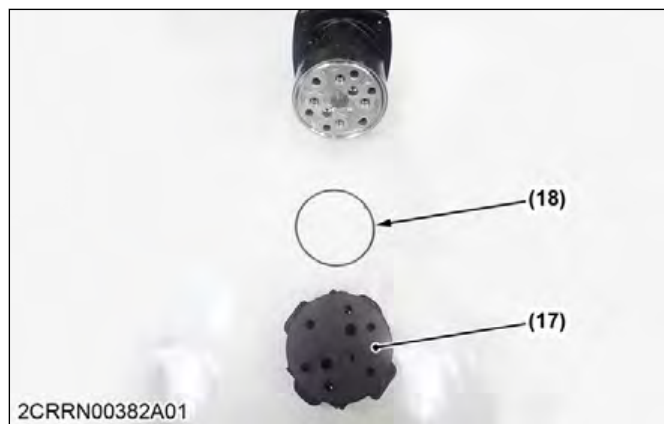
Disassembling the shuttle valve

1. Remove the 2 cap bolts and the 2 washers.



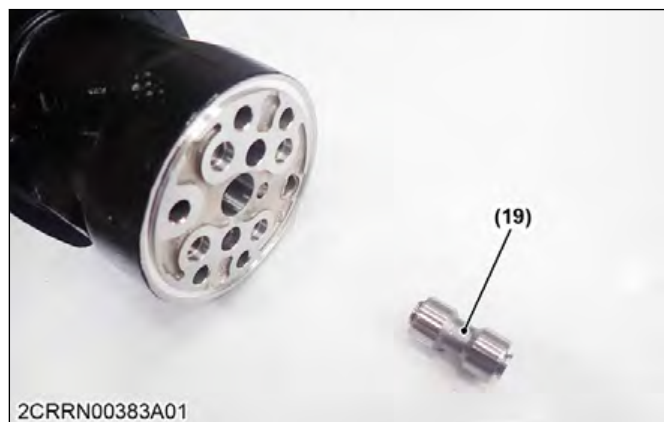
- (15) Cap bolt (M8 × 65) ×2
(16) Washer ×2

2. Remove the shuttle valve casing and the O-ring.



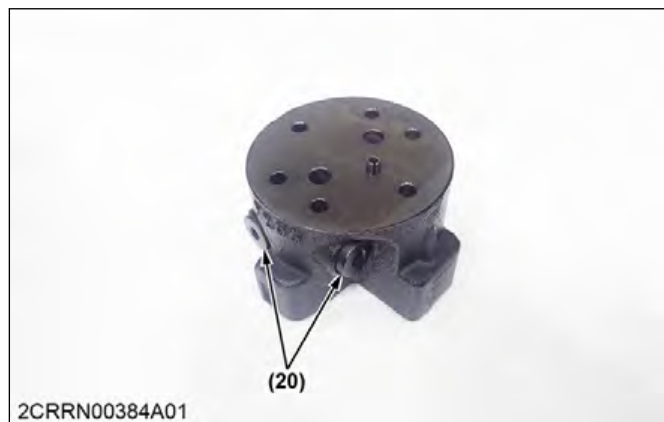
(17) Shuttle valve casing (18) O-ring

3. Remove the bushing.



(19) Bushing

4. Remove the 4 plugs.

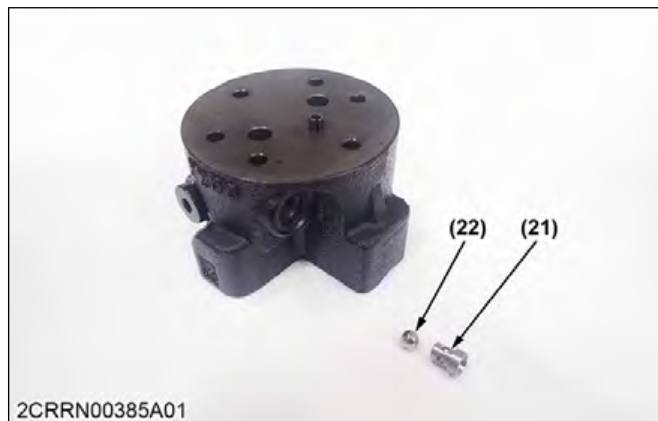


(20) Plug ×4

5. Remove the 4 balls and the 4 seats with a thin stick and radio pliers.

■ NOTE

- Be careful not to scratch the balls.



(21) Seat ×4

(22) Ball ×4

4.6.4 Assembling the pilot control valve

■ IMPORTANT

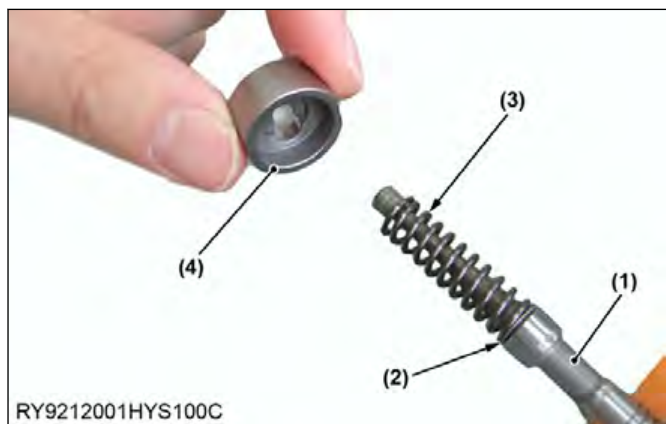
- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Do not reuse removed O-rings for assembly to avoid oil leakage.
- Apply lubricant or grease to every seal to avoid damage when assembling.
- After assembling, clean the outside of the hydraulic component.

Assembling the pressure reducing valves

1. Install the shim, the spring, and the spring seat to the spool in order.

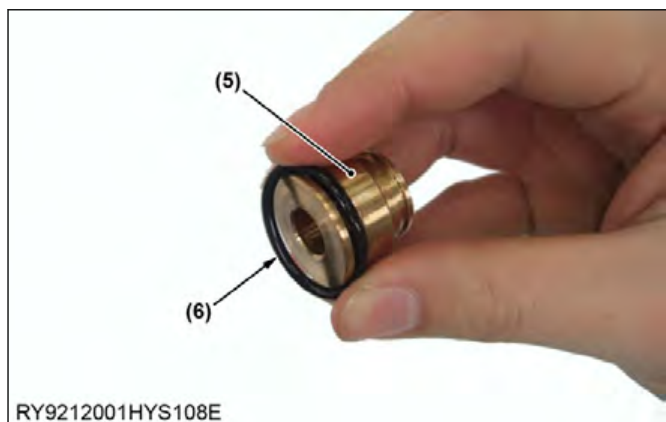
■ IMPORTANT

- Do not compress the spring more than 6 mm (0.2 in.) when handling it.



- (1) Spool
(2) Shim
(3) Spring
(4) Spring seat

2. Install the O-ring to the plug.

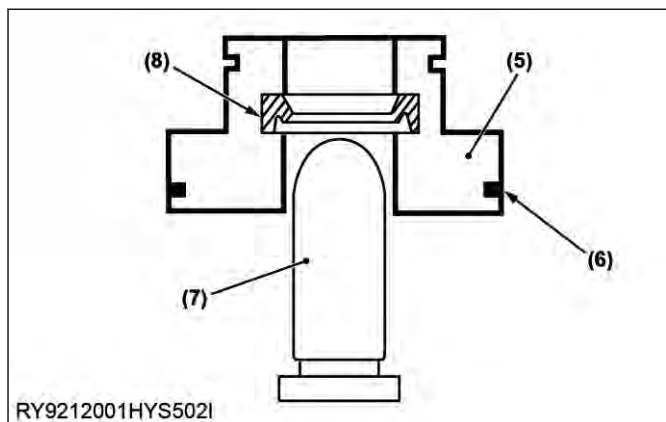


- (5) Plug
(6) O-ring

3. Install the seal to the plug.

NOTE

- Apply hydraulic oil to the seal.
- Install the seal in correct direction.

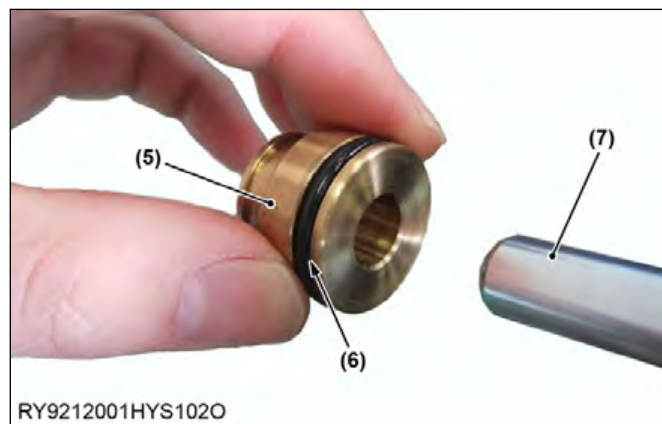


- (5) Plug
(6) O-ring
(7) Push rod
(8) Seal

4. Install the push rod to the plug.

NOTE

- Apply hydraulic oil to the push rod.



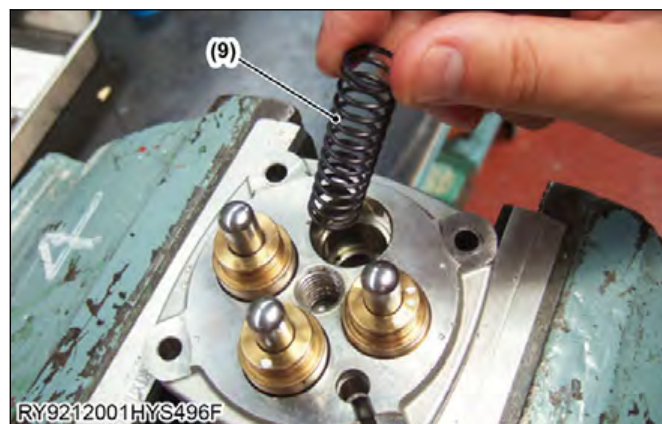
- (5) Plug
(6) O-ring
(7) Push rod

Assembling the pressure reducing valves

1. Install the 4 springs to the casing.

NOTE

- Install each spring to the same location as before.



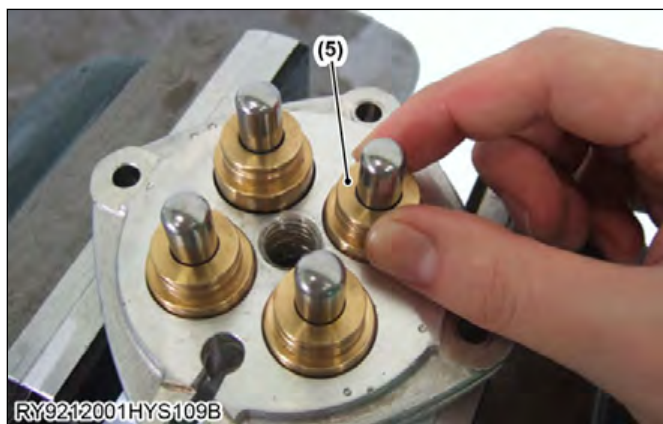
- (9) Spring ×4

2. Install the 4 pressure reducing valves to the casing.



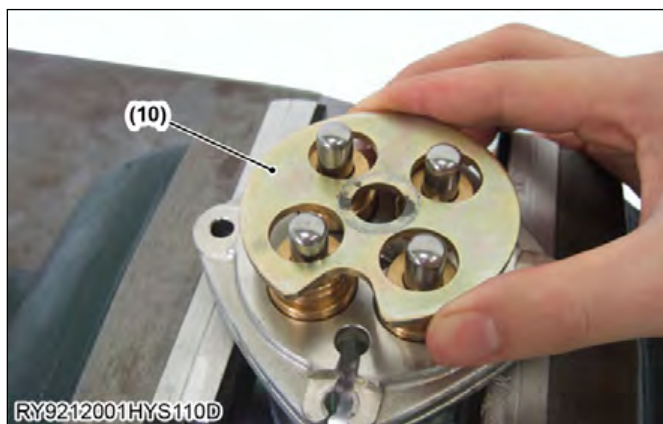
- (A) Pressure reducing valve ×4

3. Install the 4 plugs to the casing.



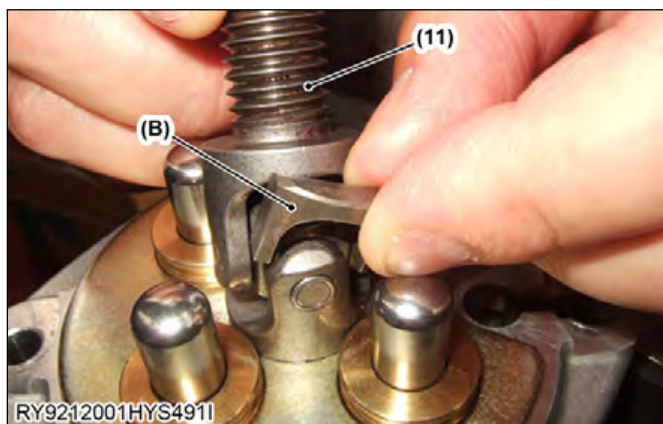
(5) Plug ×4

4. Install the plate onto the casing.



(10) Plate

5. Install the universal joint with the universal joint tightening jigs 1 and 2.



(11) Universal joint

(B) Universal joint tightening jig 1

(C) Universal joint tightening jig 2

Tightening torque

(11) Universal joint	44.2 to 50.0 N·m 4.51 to 5.10 kgf·m 32.6 to 36.9 lbf·ft	—
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6. Install the disc nut.

NOTE

- Tighten the disc nut until the tips of the 4 push rods of the pressure reducing valves touch evenly.
- Do not screw in the disc nut excessively to prevent the mechanical malfunction.

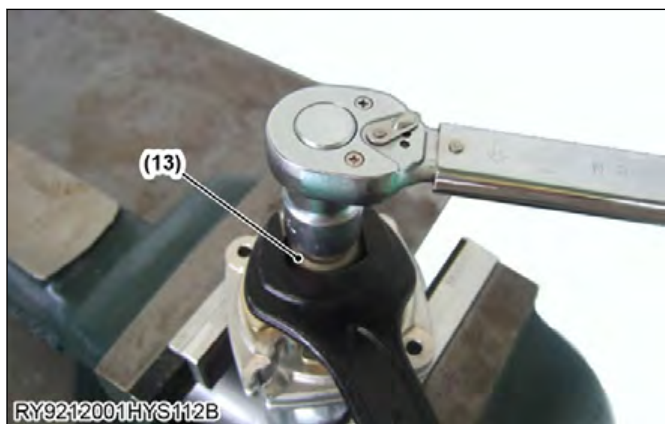


(12) Disc nut

Tightening torque

(12) Disc nut	63.7 to 73.5 N·m 6.5 to 7.5 kgf·m 47.0 to 54.2 lbf·ft	—
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7. Install the adjusting nut.



(13) Adjusting nut

Tightening torque

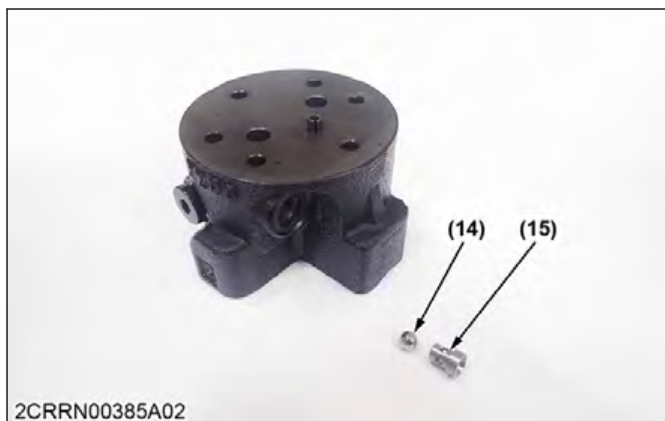
(13) Adjusting nut	63.7 to 73.5 N · m 6.5 to 7.5 kgf · m 47.0 to 54.2 lbf · ft	—
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8. Grease the universal joint and the push rods.



Assembling the shuttle valve

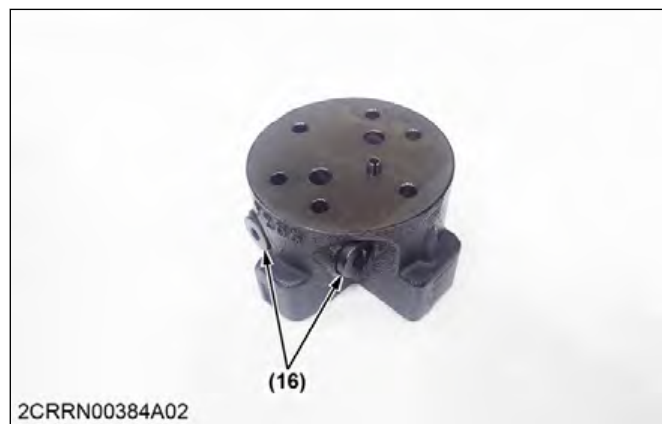
1. Install the 4 balls and the 4 seats.



(14) Ball

(15) Seat

2. Install the 4 plugs.

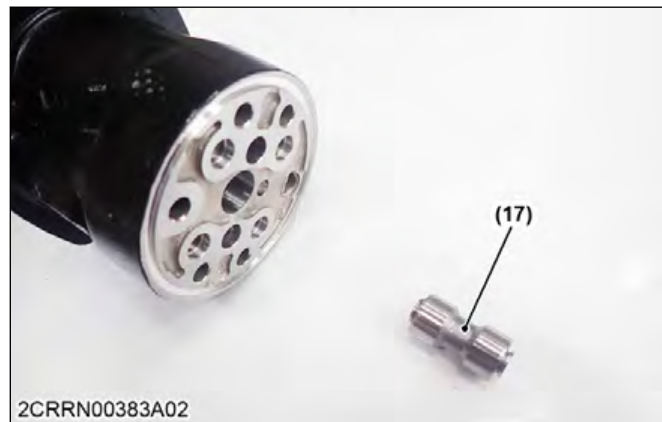


(16) Plug ×4

Tightening torque

(16) Plug	10.8 to 12.8 N · m 1.10 to 1.31 kgf · m 7.97 to 9.44 lbf · ft	—
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3. Install the bushing.

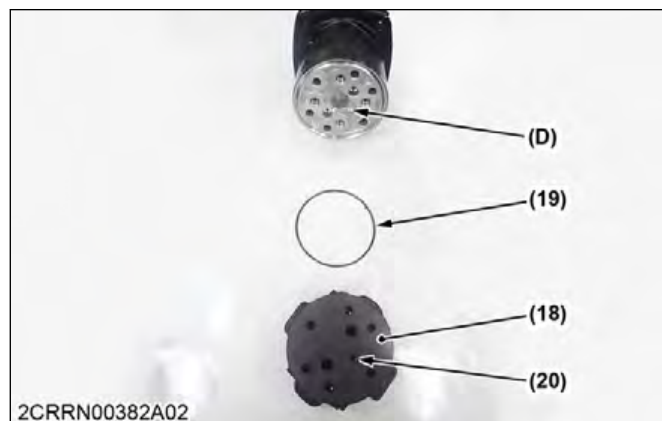


(17) Bushing

4. Install the shuttle valve casing and the O-ring.

NOTE

- Make sure that the spring pin is installed to the spring pin hole.



(18) Shuttle valve casing

(19) O-ring

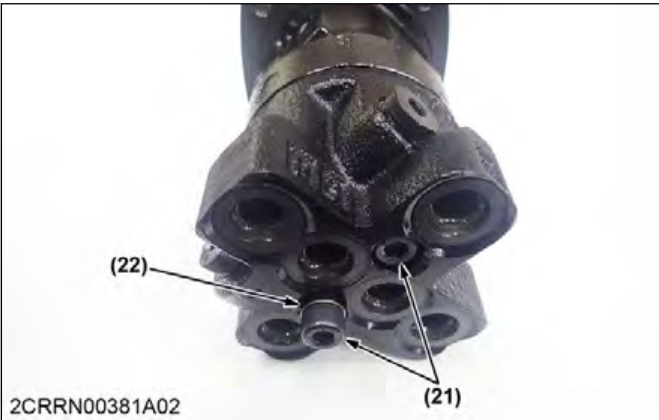
(20) Spring pin

(D) Spring pin hole

5. Install the 2 cap bolts and the 2 washers.

■ NOTE

- Do not reuse the used washer when assembling.

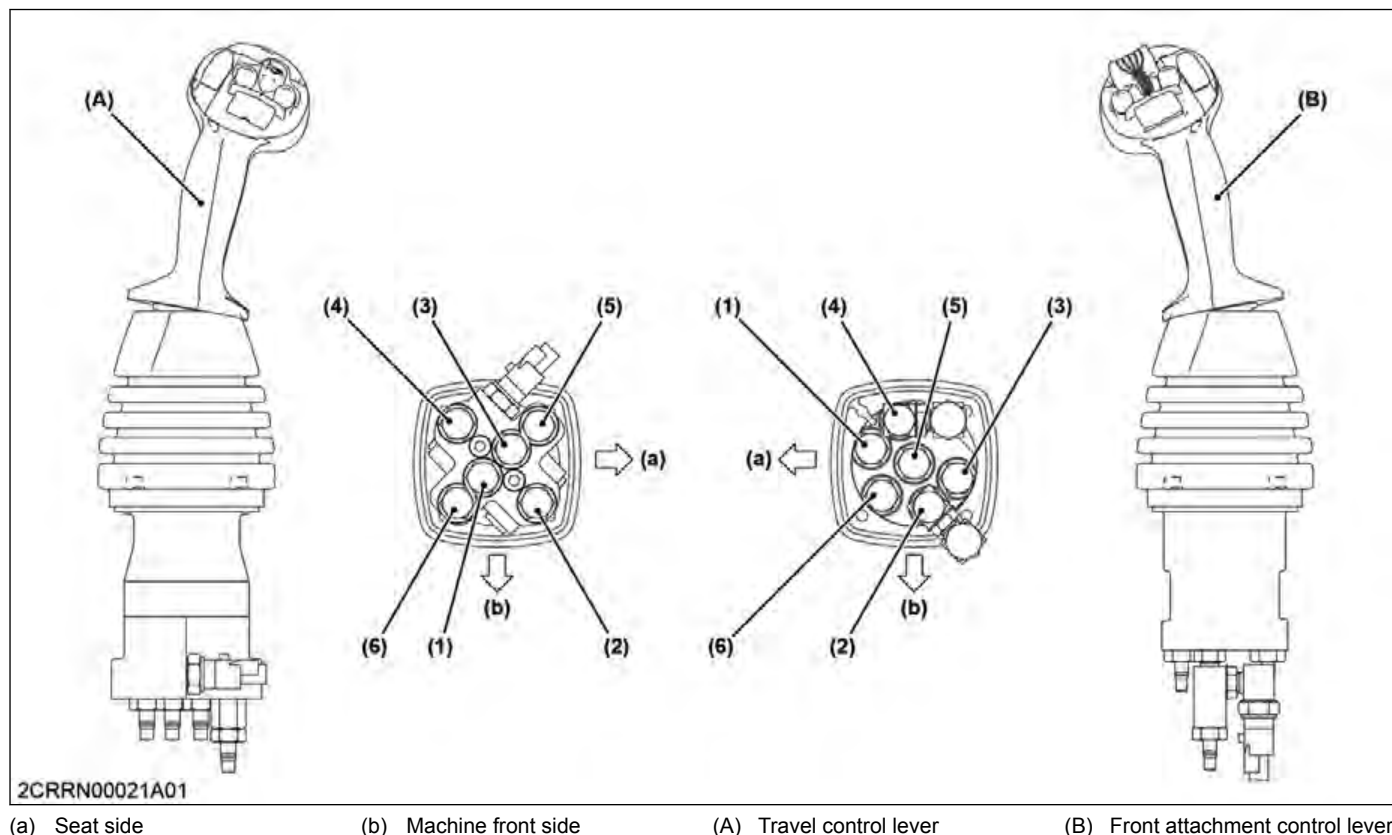


(21) Cap bolt (M8 × 65) ×2 (22) Washer ×2

Tightening torque

(21) Cap bolt	19.1 to 22.1 N · m 1.95 to 2.25 kgf · m 14.1 to 16.3 lbf · ft	—
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4.6.5 Installing adapters for the pilot control valves



No.	Port	Adapter size		Angle
		Travel control valve	Front attachment control valve	
(1)	Port 1	G1/4-Quick coupler	G1/4-Quick coupler	—
(2)	Port 2	G1/4-Quick coupler	G1/4-Quick coupler	—
(3)	Port 3	G1/4-Quick coupler	G1/4-Quick coupler	—
(4)	Port 4	G1/4-Quick coupler	G1/4-Quick coupler	—
(5)	Port P	G1/4-Quick coupler	G1/4-Quick coupler	—
(6)	Port T	G1/4-Quick coupler	G1/4-Quick coupler	—

4.7 Unload valve

4.7.1 Removing and installing the unload valve

CAUTION

- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.
- Before disconnecting the hydraulic hoses, release the residual pressure first.

IMPORTANT

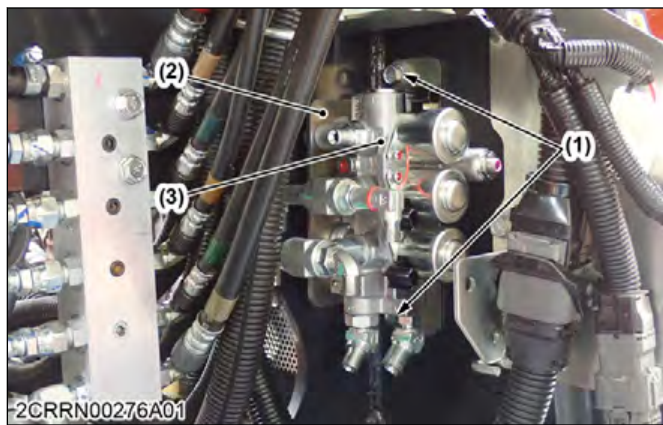
- Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Lower the front attachment to the ground and stop the engine.
3. Tilt up the cab.
4. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.

Removing

1. Disconnect the hydraulic hoses and wire harness from the unload valve.
2. Remove the 2 bolts and the stay with the unload valve.

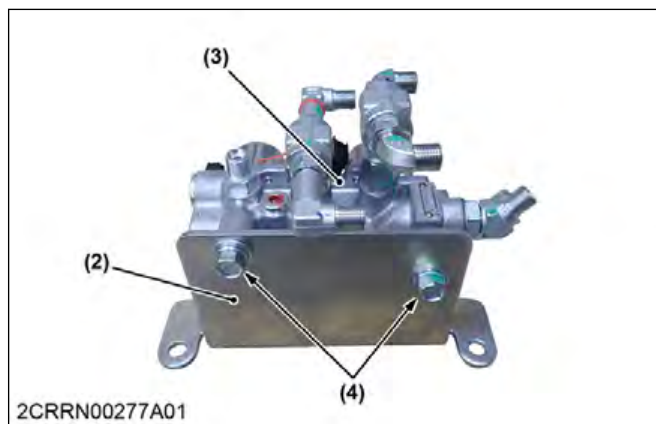


- (1) Bolt (M10 × 30) ×2 (3) Unload valve
(2) Stay

Mass

(3) Unload valve (including the stay)	Approximately 3.5 kg Approximately 7.7 lbs
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3. Remove the 2 bolts and the stay.



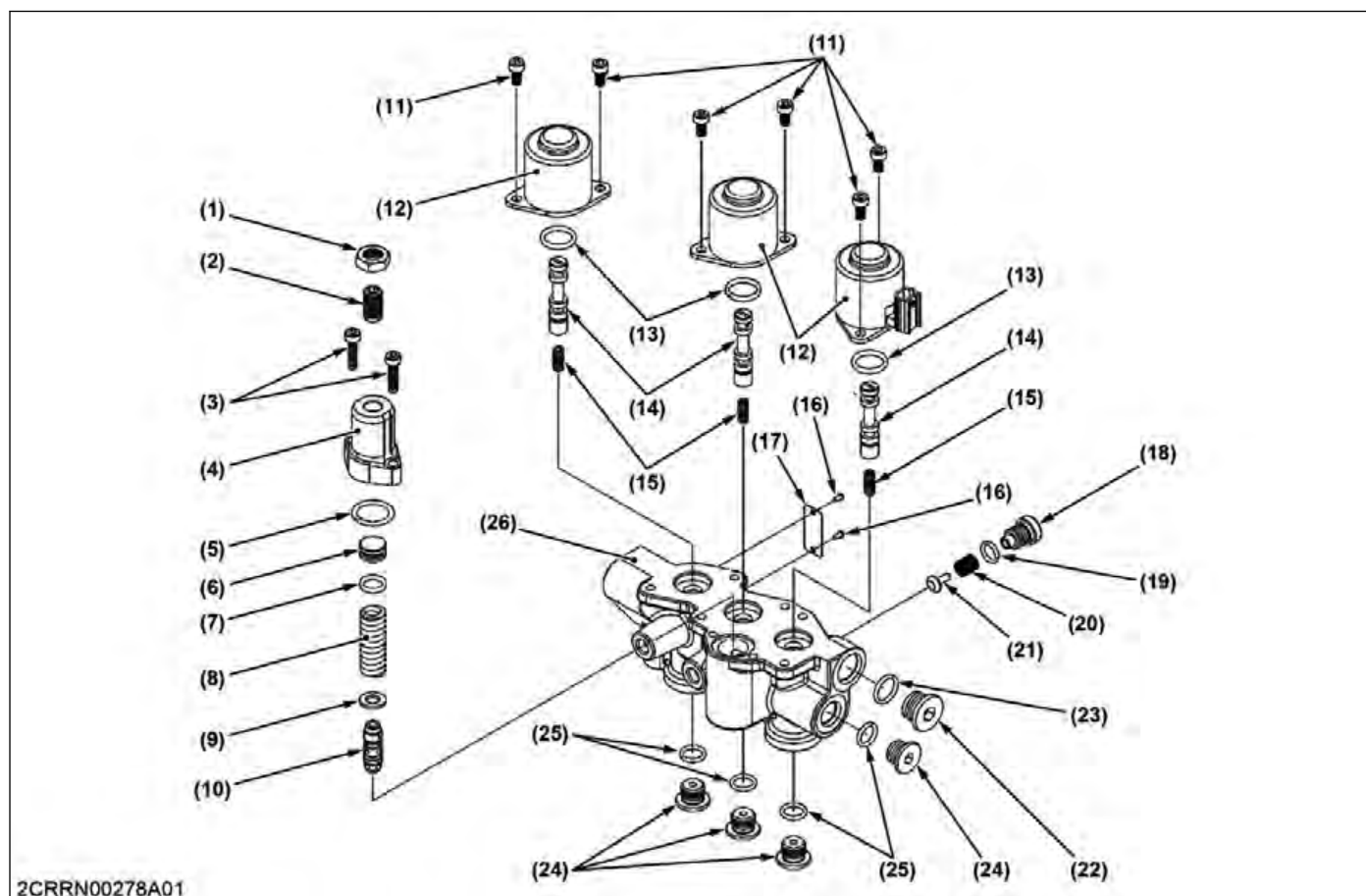
- (2) Stay (4) Bolt (M10 × 20) ×2
(3) Unload valve

Installing

Tightening torque

(4) Bolt	39.2 to 45.1 N·m 4.0 to 4.6 kgf·m 28.9 to 33.3 lbf·ft	—
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4.7.2 Unload valve components



- | | | | |
|--------------------------|---------------------------|-----------------|----------------|
| (1) Nut | (8) Spring | (15) Spring ×3 | (22) Plug |
| (2) Adjustment screw | (9) Washer | (16) Screw ×2 | (23) O-ring |
| (3) Cap bolt (M5 ×20) ×2 | (10) Plunger | (17) Name plate | (24) Plug ×3 |
| (4) Cover | (11) Cap bolt (M5 ×10) ×6 | (18) Plug | (25) O-ring ×3 |
| (5) O-ring | (12) Solenoid ×3 | (19) O-ring | (26) Body |
| (6) Plug | (13) O-ring ×3 | (20) Spring | |
| (7) O-ring | (14) Spool ×3 | (21) Plunger | |

4.7.3 Disassembling and assembling the unload valve

■ IMPORTANT

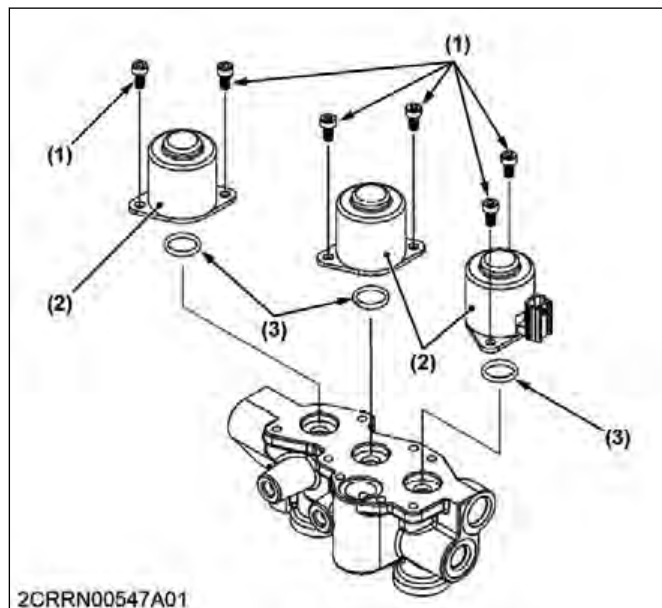
- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Do not reuse removed O-rings for assembly to avoid oil leakage.
- Apply lubricant or grease to every seal to avoid damage when assembling.
- After assembling, clean the outside of the hydraulic component.

Disassembling

1. Remove the 6 cap bolts, 3 solenoids, and 3 O-rings.

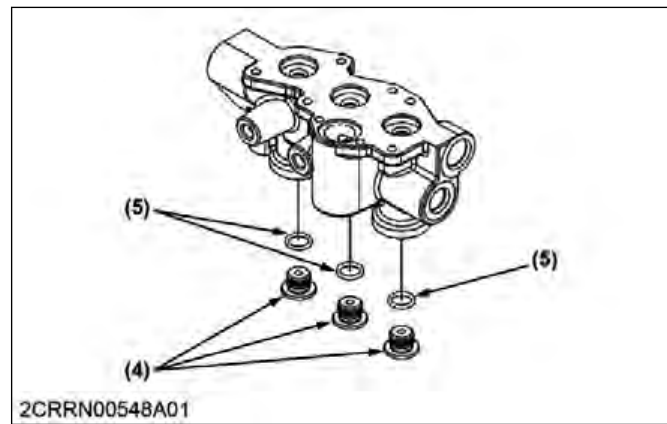
■ NOTE

- Be careful not to drop the push rod from the solenoid.
- When assembling, install the O-ring to the solenoid.
- When assembling, install the solenoids to the same positions as before.



- (1) Cap bolt (M5 × 10) × 6 (3) O-ring × 3
(2) Solenoid × 3

2. Remove the 3 plugs and 3 O-rings.

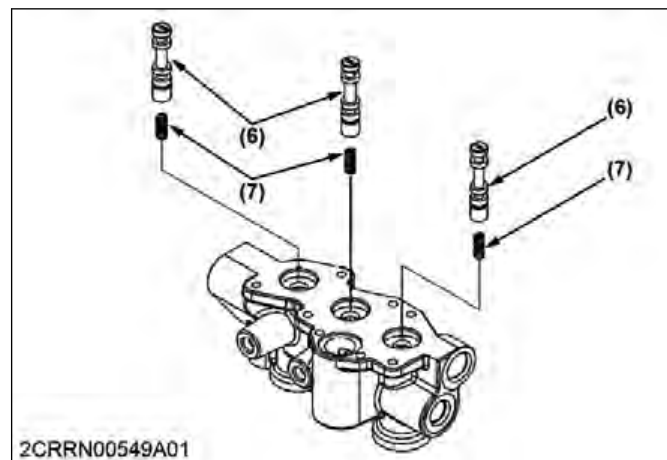


- (4) Plug × 3 (5) O-ring × 3

3. Remove the 3 springs and 3 spools.

■ NOTE

- When assembling, install the spools to the same positions as before.

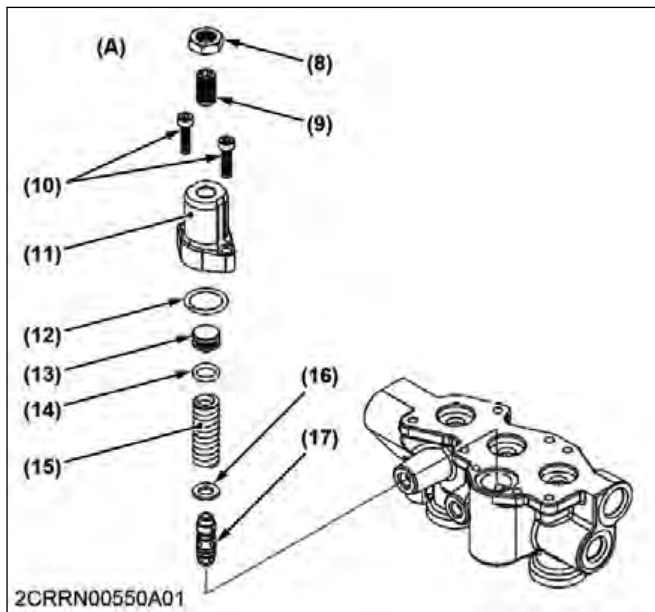


- (6) Spring × 3 (7) Spool × 3

4. Remove the 2 cap bolts, and remove the unload relief valve.

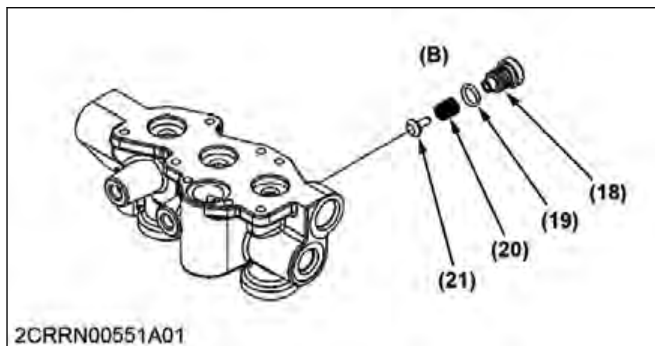
■ NOTE

- Use radio pliers when removing the spring, washer, and plunger.



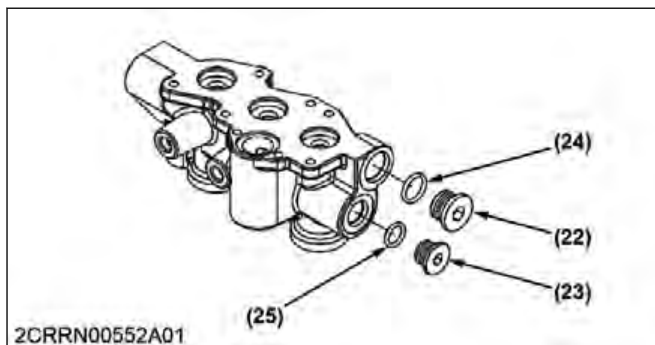
- (8) Nut
(9) Adjustment screw
(10) Cap bolt (M5 x 20) x2
(11) Cover
(12) O-ring
(13) Plug
(14) O-ring
(15) Spring
(16) Washer
(17) Plunger
(A) Unload relief valve

5. Remove the check valve components.



- (18) Plug
(19) O-ring
(20) Spring
(21) Plunger
(B) Check valve components

6. Remove the 2 plugs and 2 O-rings.



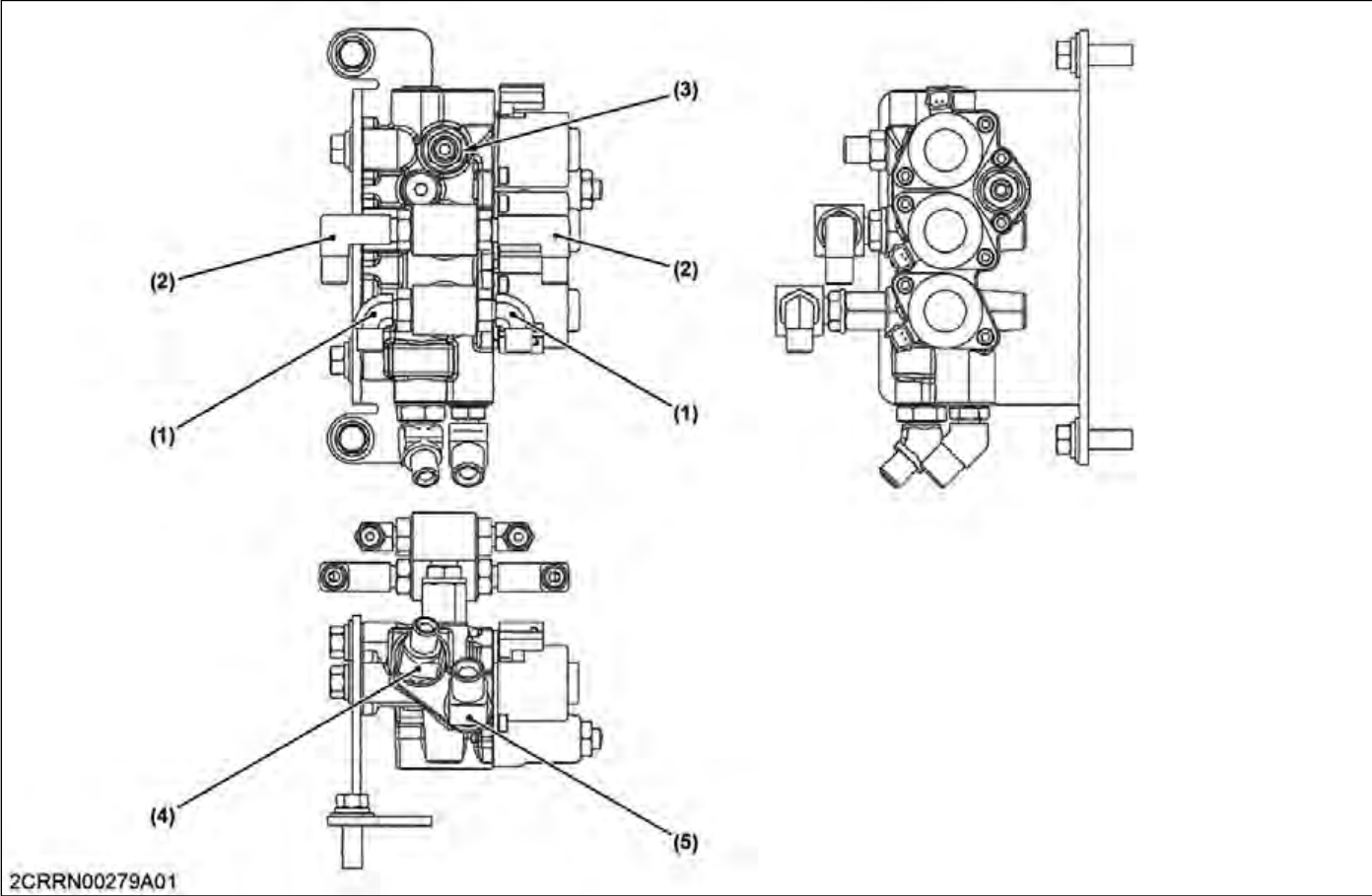
- (22) Plug
(23) Plug
(24) O-ring
(25) O-ring

Assembling

Tightening torque

(1) (10) Cap bolt	3.53 to 4.31 N · m 0.36 to 0.44 kgf · m 2.60 to 3.18 lbf · ft	—
(4) (23) Plug	23.9 to 29.2 N · m 2.44 to 2.98 kgf · m 17.6 to 21.5 lbf · ft	—
(8) Nut	14.1 to 17.3 N · m 1.44 to 1.76 kgf · m 10.4 to 12.8 lbf · ft	—
(18) Plug	18.9 to 23.1 N · m 1.93 to 2.36 kgf · m 13.9 to 17.0 lbf · ft	—
(22) Plug	43.7 to 53.4 N · m 4.46 to 5.45 kgf · m 32.2 to 39.4 lbf · ft	—

4.7.4 Installing adapters for the unload valve



No.	Port	Adapter size	Angle
(1)	A1	G1/4-G1/4	—
(2)	A2	G1/4-G1/4	—
(3)	A3	G1/4-G1/4	—
(4)	P	G3/8-G1/4	10°
(5)	T2	G1/4-G3/8	—

4.8 Hydraulic quick hitch solenoid valve

4.8.1 Removing and installing the hydraulic quick hitch solenoid valve

CAUTION

- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.
- Before disconnecting the hydraulic hoses, release the residual pressure first.

IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Jack up the machine.
3. Lower the front attachment to the ground and stop the engine.
4. Remove the 4 bolts and the cover.



- (1) Cover (2) Bolt (M12 × 30) × 4

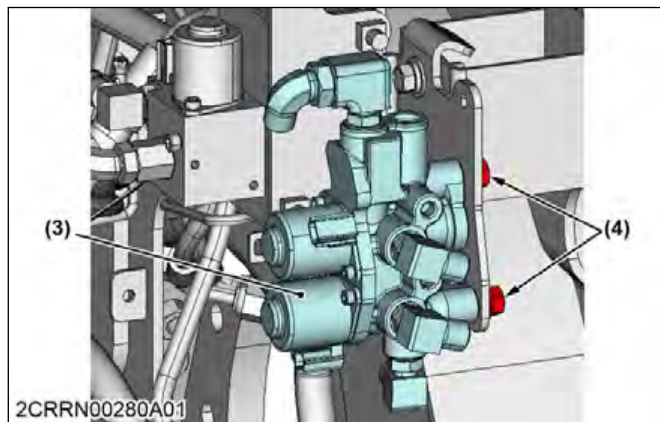
5. Put an oil pan under the machine.
6. Open the rear bonnet and the upper bonnet.
7. Remove the radiator.
8. Remove the fan.
9. Remove the battery.
10. Remove the negative (-) cable from the machine body.
11. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.



- (3) Hydraulic quick hitch solenoid valve

Removing

1. Disconnect the hydraulic hoses and wire harness from the hydraulic quick hitch solenoid valve.
2. Remove the 2 bolts and the hydraulic quick hitch solenoid valve.



- (3) Hydraulic quick hitch solenoid valve (4) Bolt (M10 × 20) × 2

Mass

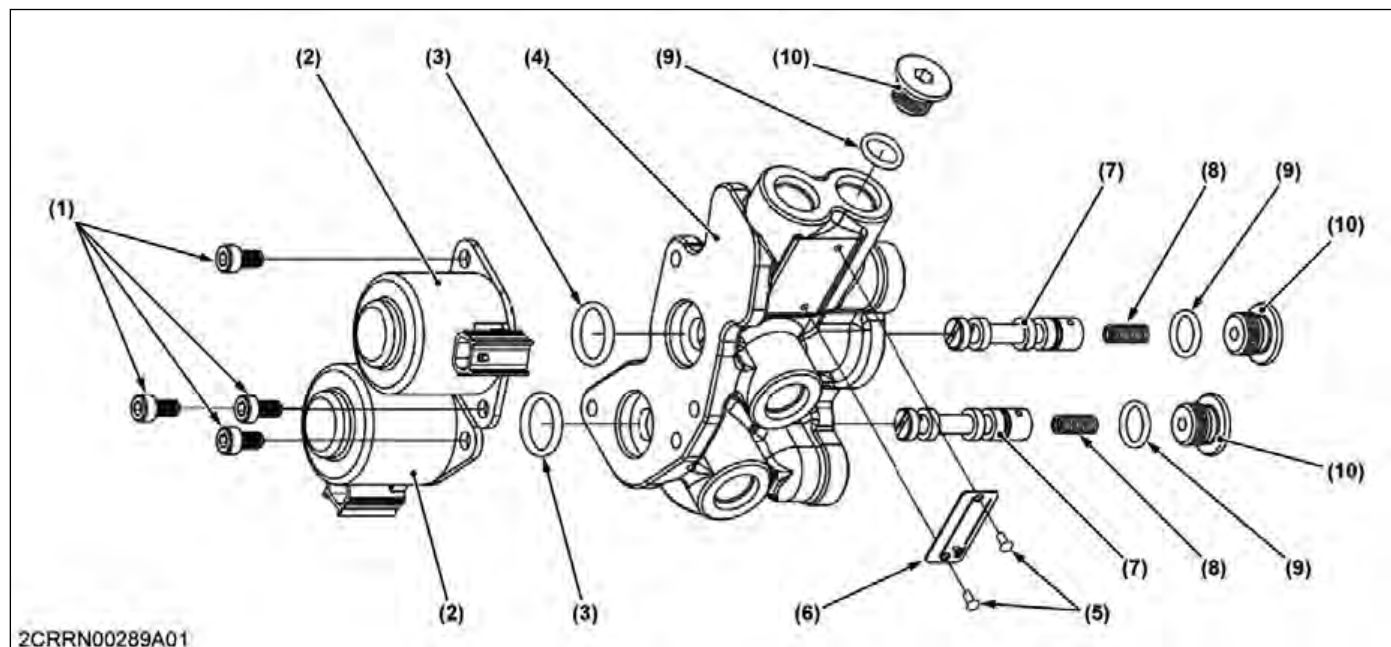
(3) Hydraulic quick hitch solenoid valve	Approximately 1.7 kg Approximately 3.7 lbs
--	---

Installing

Tightening torque

(4) Bolt	39.2 to 45.1 N · m 4.0 to 4.6 kgf · m 28.9 to 33.3 lbf · ft	—
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4.8.2 Hydraulic quick hitch solenoid valve components



(1) Cap bolt (M5 ×10) ×4
 (2) Solenoid ×2
 (3) O-ring ×2

(4) Body
 (5) Screw ×2
 (6) Name plate

(7) Spool ×2
 (8) Spring ×2
 (9) O-ring ×3

(10) Plug ×3

4.8.3 Disassembling and assembling the hydraulic quick hitch solenoid valve

■ IMPORTANT

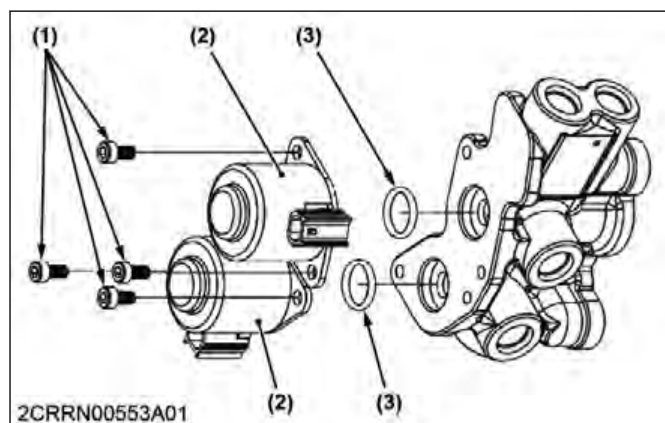
- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Do not reuse removed O-rings for assembly to avoid oil leakage.
- Apply lubricant or grease to every seal to avoid damage when assembling.
- After assembling, clean the outside of the hydraulic component.

Disassembling

1. Remove the 4 cap bolts, 2 solenoids, and 2 O-rings.

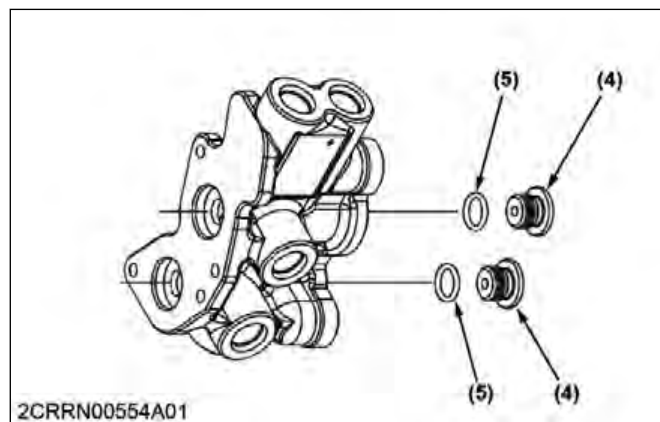
■ NOTE

- Be careful not to drop the push rod from the solenoid.
- When assembling, install the O-ring to the solenoid.
- When assembling, install the solenoids to the same positions as before.



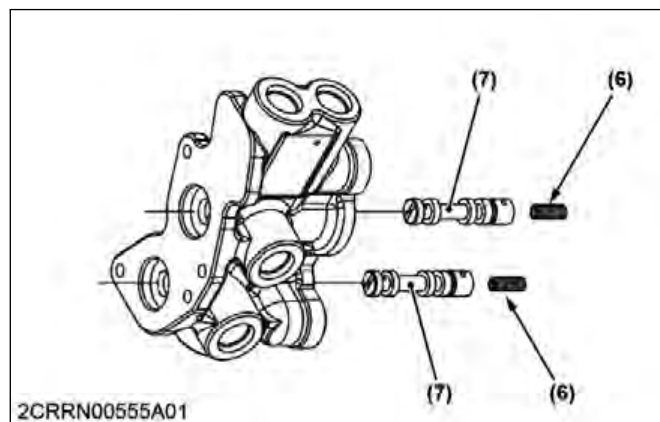
- (1) Cap bolt (M5 × 10) ×4 (3) O-ring ×2
(2) Solenoid ×2

2. Remove the 2 plugs and 2 O-rings.



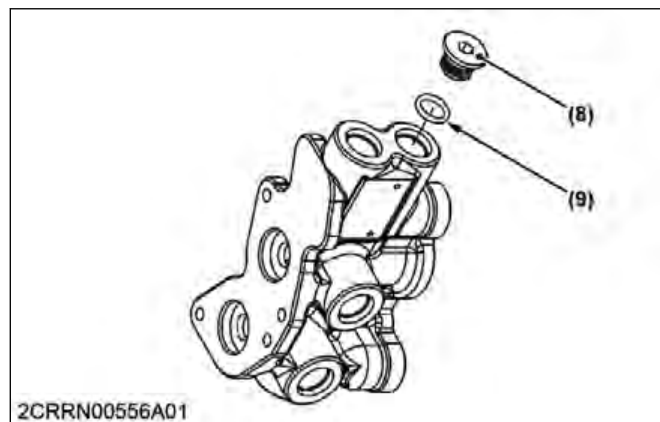
- (4) Plug ×2 (5) O-ring ×2

3. Remove the 2 springs and the 2 spools.



- (6) Spring ×2 (7) Spool ×2

4. Remove the plug and O-ring.



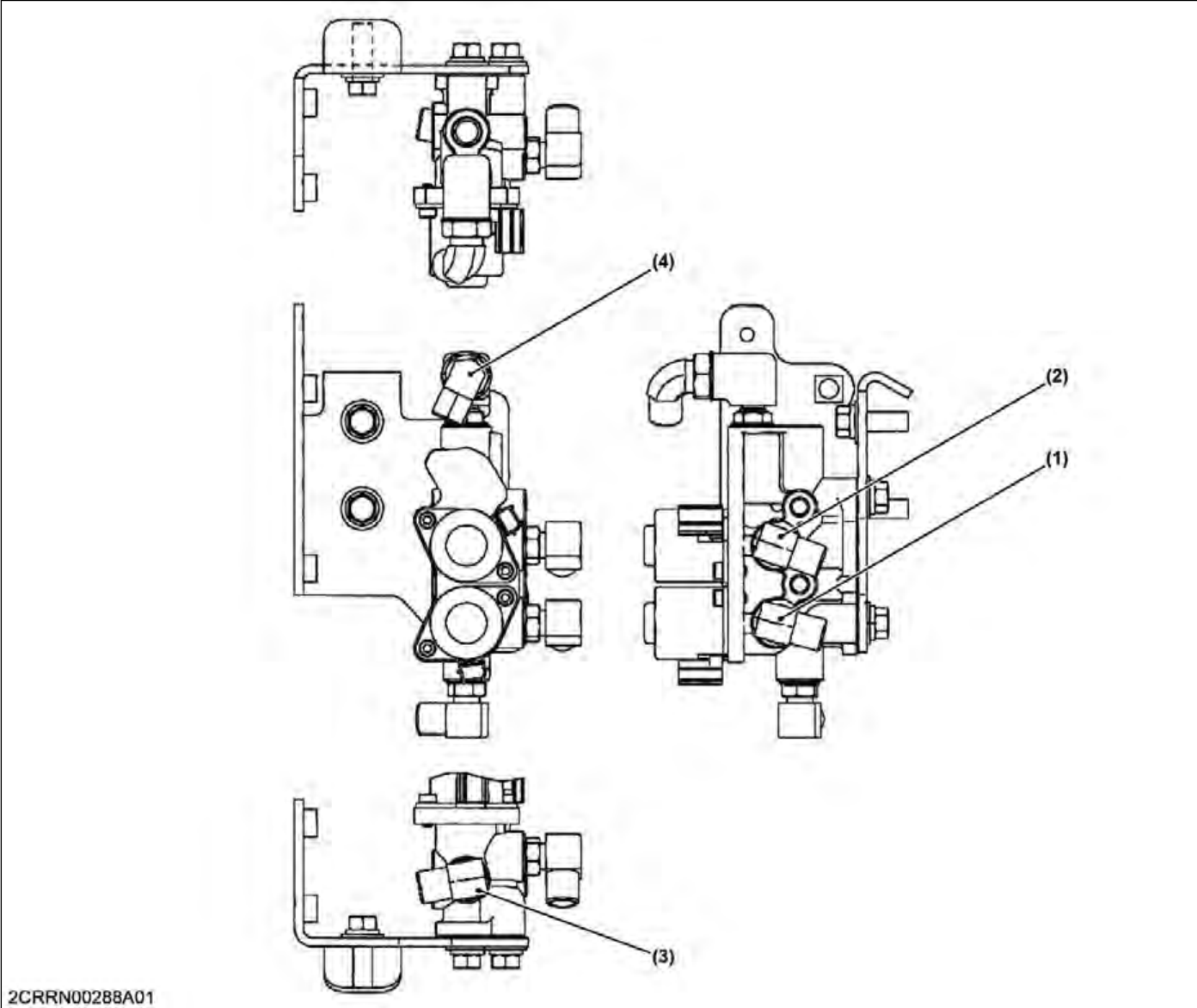
- (8) Plug (9) O-ring

Assembling

Tightening torque

(1) Cap bolt	3.53 to 4.31 N · m 0.36 to 0.44 kgf · m 2.60 to 3.18 lbf · ft	—
(4) (8) Plug	23.9 to 29.2 N · m 2.44 to 2.98 kgf · m 17.6 to 21.5 lbf · ft	—

4.8.4 Installing adapters for the hydraulic quick hitch solenoid valve



No.	Port	Adapter size	Angle
(1)	A	G1/4-G3/8	15°
(2)	B	G1/4-G3/8	20°
(3)	P	G1/4-G3/8	15°
(4)	T	G3/8-G3/8	65°

4.9 Self-leveling solenoid valve

4.9.1 Removing and installing the self-leveling solenoid valve

CAUTION

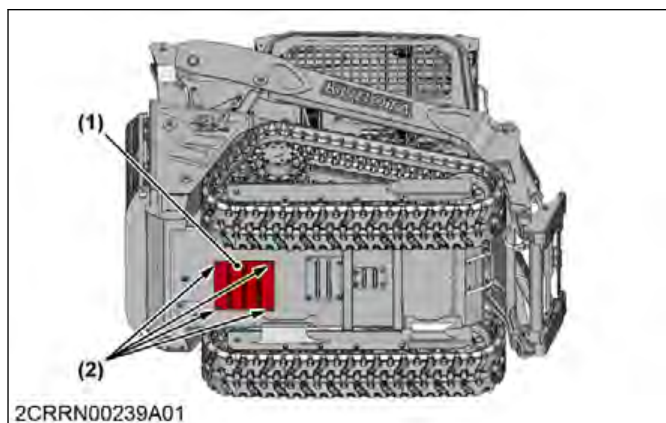
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.
- Before disconnecting the hydraulic hoses, release the residual pressure first.

IMPORTANT

- Install plugs to removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Jack up the machine.
3. Lower the lift arm and move the quick hitch to the dumping end.
4. Stop the engine.
5. Remove the 4 bolts and the cover.

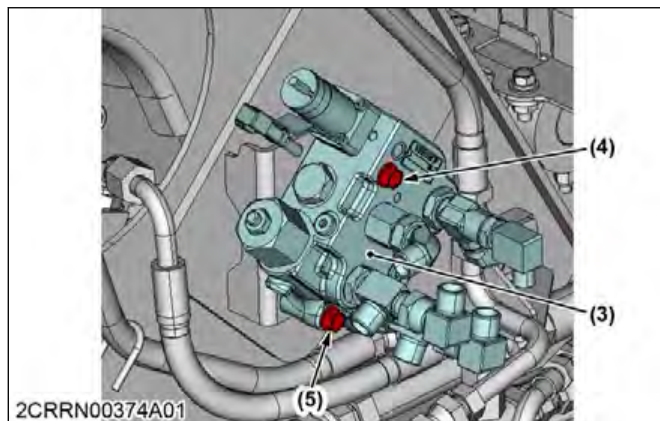
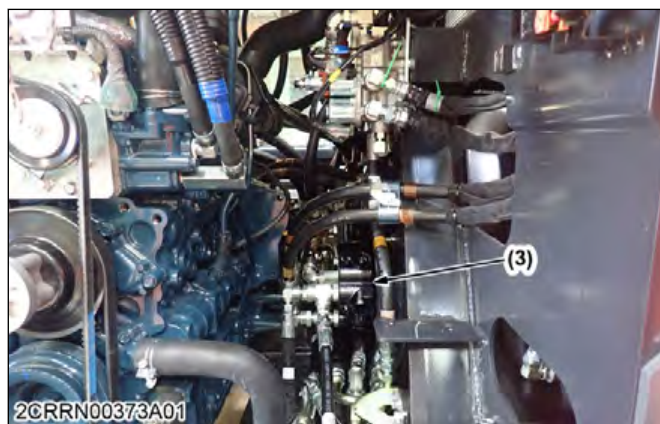


- (1) Cover (2) Bolt (M12 × 30) × 4

6. Put an oil pan under the machine.
7. Open the rear bonnet and the upper bonnet.
8. Remove the radiator.
9. Remove the fan.
10. Remove the battery.
11. Remove the negative (-) cable from the machine body.
12. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.

Removing

1. Disconnect the hydraulic hoses and wire harness from the self-leveling solenoid valve.
2. Remove the 2 bolts and the self-leveling solenoid valve.



- (3) Self-leveling solenoid valve (5) Bolt (M10 × 55)
(4) Bolt (M10 × 80)

Mass

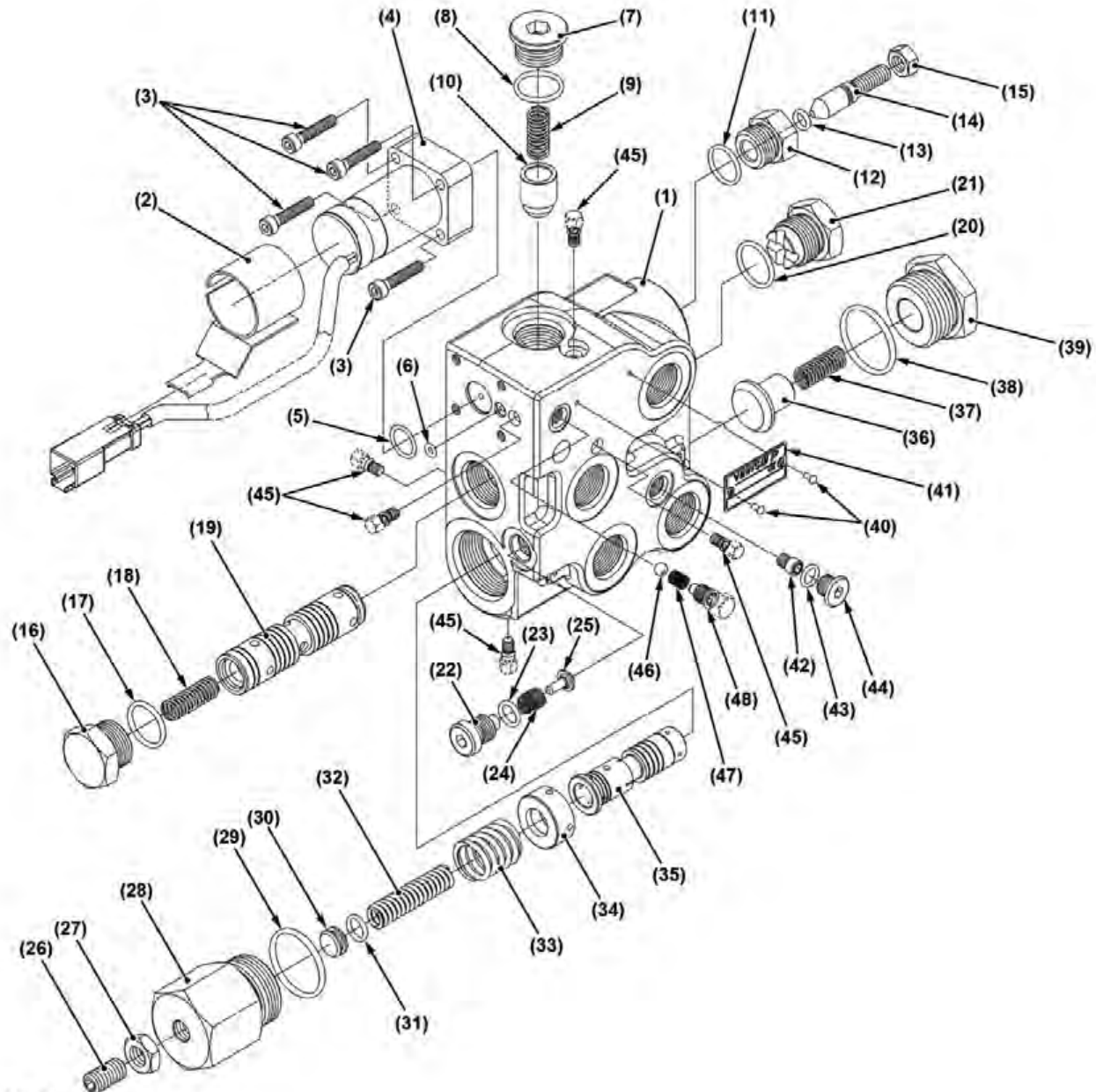
(3) Self-leveling solenoid valve	Approximately 8.5 kg Approximately 18.7 lbs
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Installing

Tightening torque

(4) (5) Bolt	48.1 to 55.9 N · m 4.9 to 5.7 kgf · m 35.5 to 41.2 lbf · ft	Thread lock (Loctite 271)
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4.9.2 Self-leveling solenoid valve components



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- | | | | |
|--|-------------------------|---------------------------------|-------------------|
| (1) Body | (13) O-ring | (26) Adjustment screw | (39) Stopper |
| (2) Clip | (14) Needle | (27) Nut | (40) Name plate |
| (3) Cap bolt (M5 ×25) ×4 | (15) Nut | (28) Stopper | (41) Rivet screw |
| (4) Solenoid valve | (16) Stopper | (29) O-ring | (42) Orifice plug |
| (5) O-ring | (17) O-ring | (30) Plug | (43) O-ring |
| (6) O-ring | (18) Spring | (31) O-ring | (44) Flange plug |
| (7) Plug | (19) Flow divider spool | (32) Spring | (45) Plug |
| (8) O-ring | (20) O-ring | (33) Spring | (46) Steel ball |
| (9) Spring | (21) Stopper | (34) Spring holder | (47) Spring |
| (10) Logic valve poppet | (22) Plug | (35) Counterbalance valve spool | (48) Plug |
| (11) O-ring | (23) O-ring | (36) Check valve poppet | |
| (12) Flow divide adjustment valve plug | (24) Spring | (37) Spring | |
| | (25) Plunger | (38) O-ring | |

4.9.3 Disassembling and assembling the self-leveling solenoid valve

■ IMPORTANT

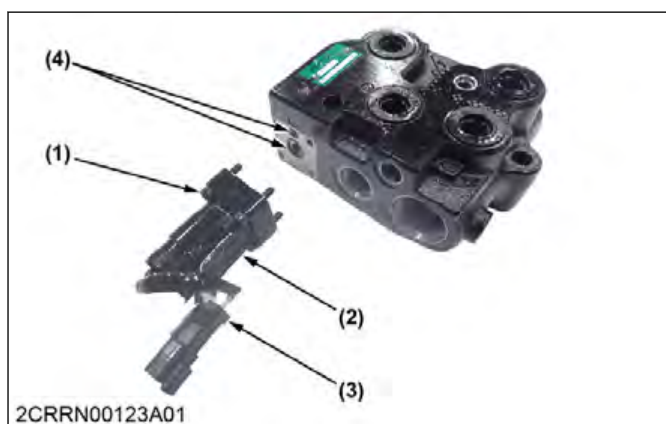
- Work at clean work space with clean tools and lubricants when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like. to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Do not reuse removed O-rings for assembly to avoid oil leakage.
- Do not reuse removed O-rings for assembly to avoid oil leakage.
- Apply lubricant or grease to every seal to avoid damage when assembling.
- After assembling, clean the outside of the hydraulic component.

Disassembling

1. Remove the 4 cap bolts, the solenoid and the 2 O-rings.

■ NOTE

- Do not remove the connector from the solenoid.



- (1) Cap bolt (M5 × 25) × 4 (4) O-ring × 2
(2) Solenoid
(3) Connector

2. Remove the plug. Pull out the spring and the plunger.



- (5) Plug (7) Plunger
(6) Spring

3. Remove the flange plug. Remove the orifice plug if necessary.

■ NOTE

- Do not remove the orifice plug except in case of malfunction. Thread lock applied to the orifice plug may cause contamination.



- (8) Flange plug (9) Orifice plug

4. Remove the plug. Pull out the spring and the logic valve poppet.



- (10) Plug (12) Logic valve poppet
(11) Spring

5. Remove the flow divide adjustment valve plug.

■ NOTE

- Do not loosen the nut except when adjusting the flow divide ratio.



(13) Flow divide adjustment valve (14) Nut plug

6. Remove the stoppers on both sides. Pull out the spring and the flow divider spool.

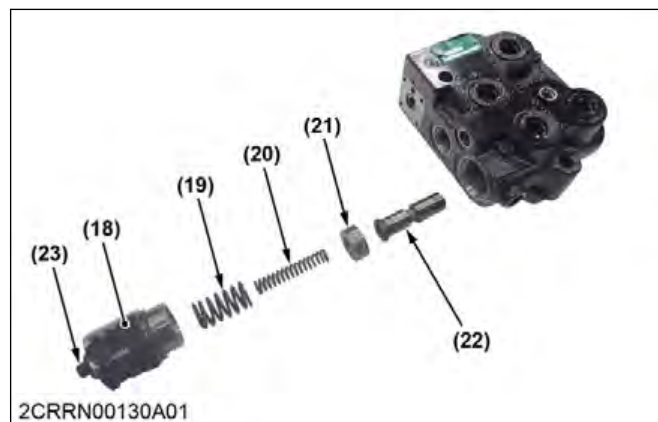


(15) Stopper (16) Spring (17) Flow divider spool

7. Remove the stopper. Pull out the 2 springs, the spring holder, and the counterbalance valve spool.

■ NOTE

- Do not loosen the nut except when adjusting the counterbalance valve cracking pressure.



(18) Stopper (19) Spring (20) Spring (21) Spring holder (22) Counterbalance valve spool (23) Nut

8. Remove the stopper, the spring and the check valve poppet.



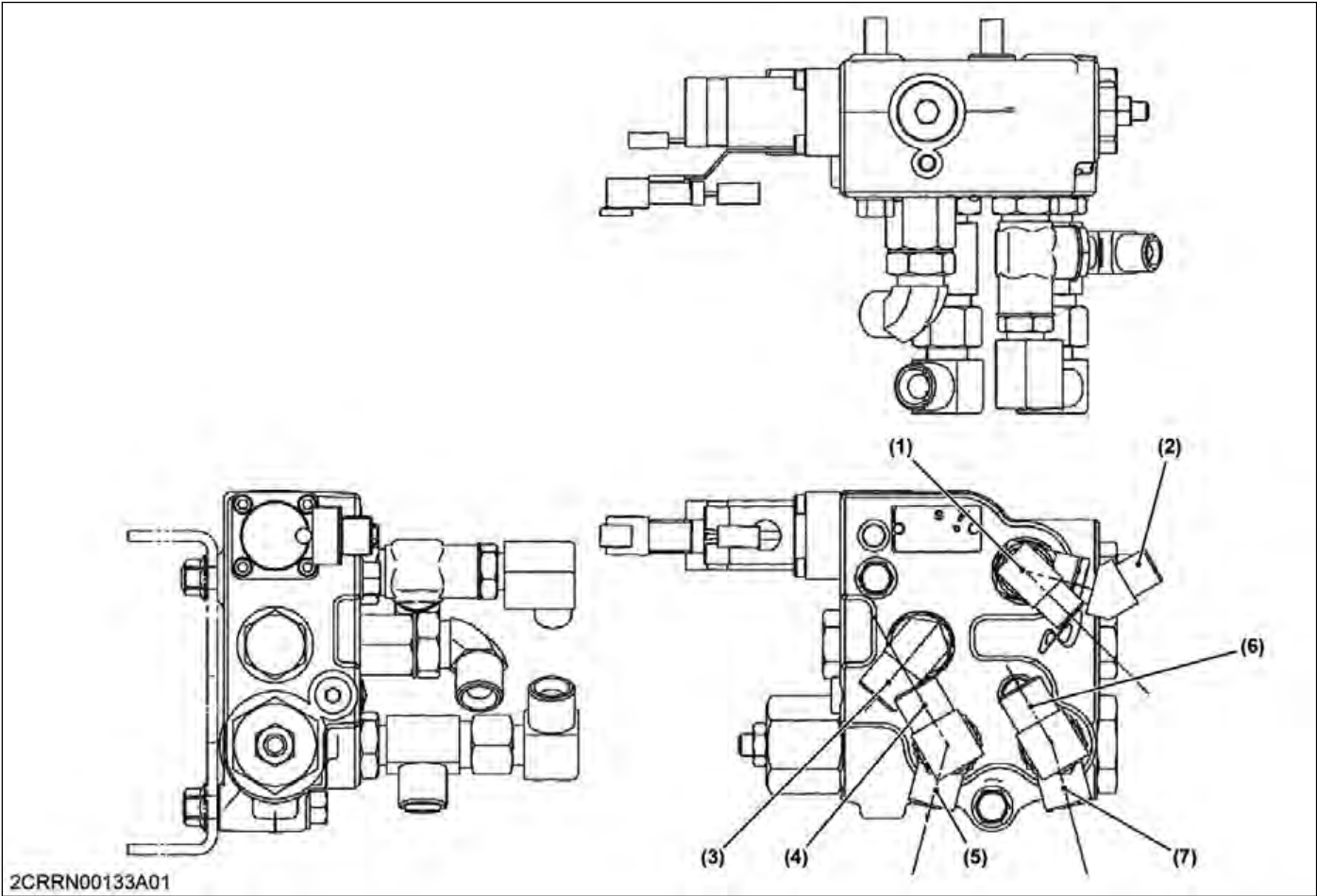
(24) Stopper (25) Spring (26) Check valve poppet

Assembling

Tightening torque

(1) Cap bolt	5.6 to 6.8 N · m 0.57 to 0.69 kgf · m 4.1 to 5.0 lbf · ft	—
(5) Plug	18.9 to 23.1 N · m 1.93 to 2.36 kgf · m 13.9 to 17.0 lbf · ft	—
(8) Flange plug	8.8 to 10.8 N · m 0.90 to 1.10 kgf · m 6.5 to 7.8 lbf · ft	—
(9) Orifice plug	5.3 to 6.5 N · m 0.54 to 0.66 kgf · m 3.9 to 4.8 lbf · ft	Thread lock (Loctite 243)
(10) Plug	68.4 to 83.6 N · m 6.97 to 8.52 kgf · m 50.4 to 61.7 lbf · ft	—
(13) Flow divide adjustment valve plug	53.6 to 65.5 N · m 5.47 to 6.68 kgf · m 39.5 to 48.3 lbf · ft	—
(14) Nut	8.8 to 10.8 N · m 0.90 to 1.10 kgf · m 6.5 to 7.8 lbf · ft	—
(15) Stopper	68.4 to 83.6 N · m 6.97 to 8.52 kgf · m 50.4 to 61.7 lbf · ft	—
(18) (24) Stopper	106.2 to 129.8 N · m 10.83 to 13.20 kgf · m 78.3 to 95.7 lbf · ft	—
(23) Nut	16.7 to 20.5 N · m 1.70 to 2.09 kgf · m 12.3 to 15.1 lbf · ft	—

4.9.4 Installing adapters for the self-leveling solenoid valve



Adapter	Port	Adapter size	Angle
(1)	A	G3/8-G3/8	45°
(2)		G3/8-G3/8	75°
(3)	B	G1/2-G1/2	40°
(4)	C	G1/2-G1/2	30°
(5)		G1/2-G1/2	15°
(6)	D	G1/2-G1/2	30°
(7)		G1/2-G1/2	15°

4.10 High-flow solenoid valve

4.10.1 Removing and installing the high-flow solenoid valve



CAUTION

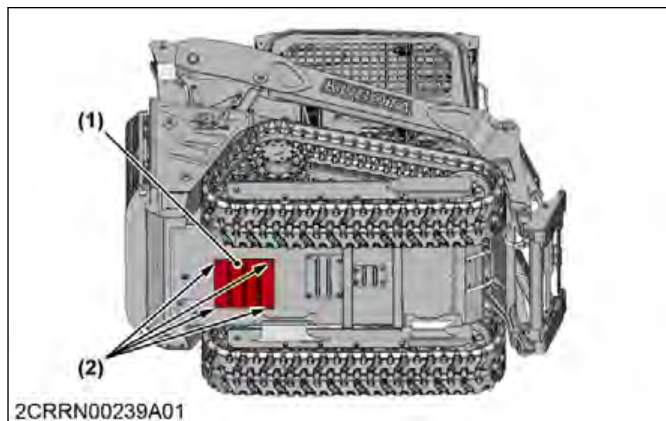
- The hydraulic devices and oil are extremely hot. Handle with care before preparation, measurement, and restoration.
- Before disconnecting the hydraulic hoses, release the residual pressure first.

■ IMPORTANT

- Install plugs to the removed hydraulic hoses and adapters to avoid oil leakage and dust contamination.

Preparing

1. Park the machine on the firm and level ground.
2. Jack up the machine.
3. Lower the front attachment to the ground and stop the engine.
4. Remove the 4 bolts and the cover.

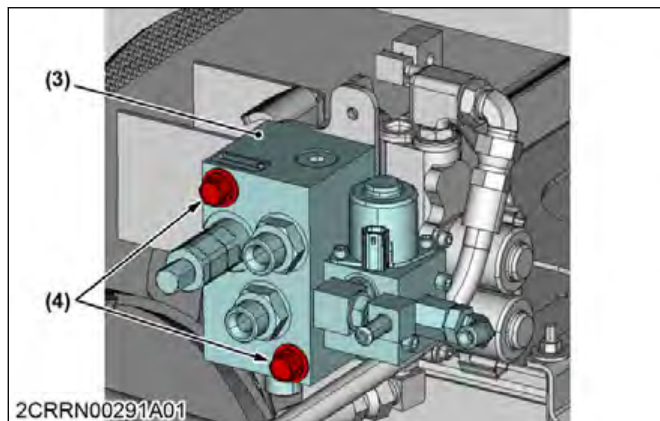


(1) Cover (2) Bolt (M12 × 30) × 4

5. Put an oil pan under the machine.
6. Tilt up the cab.
7. Open the rear bonnet and the upper bonnet.
8. Remove the air cleaner.
9. Install the vacuum pump to the hydraulic oil tank and vacuum the hydraulic oil tank.

Removing

1. Disconnect the hydraulic hoses and wire harness from the high-flow solenoid valve.
2. Remove the 2 bolts and the high-flow solenoid valve.



(3) High-flow solenoid valve (4) Bolt (M10 × 90) × 2

Mass

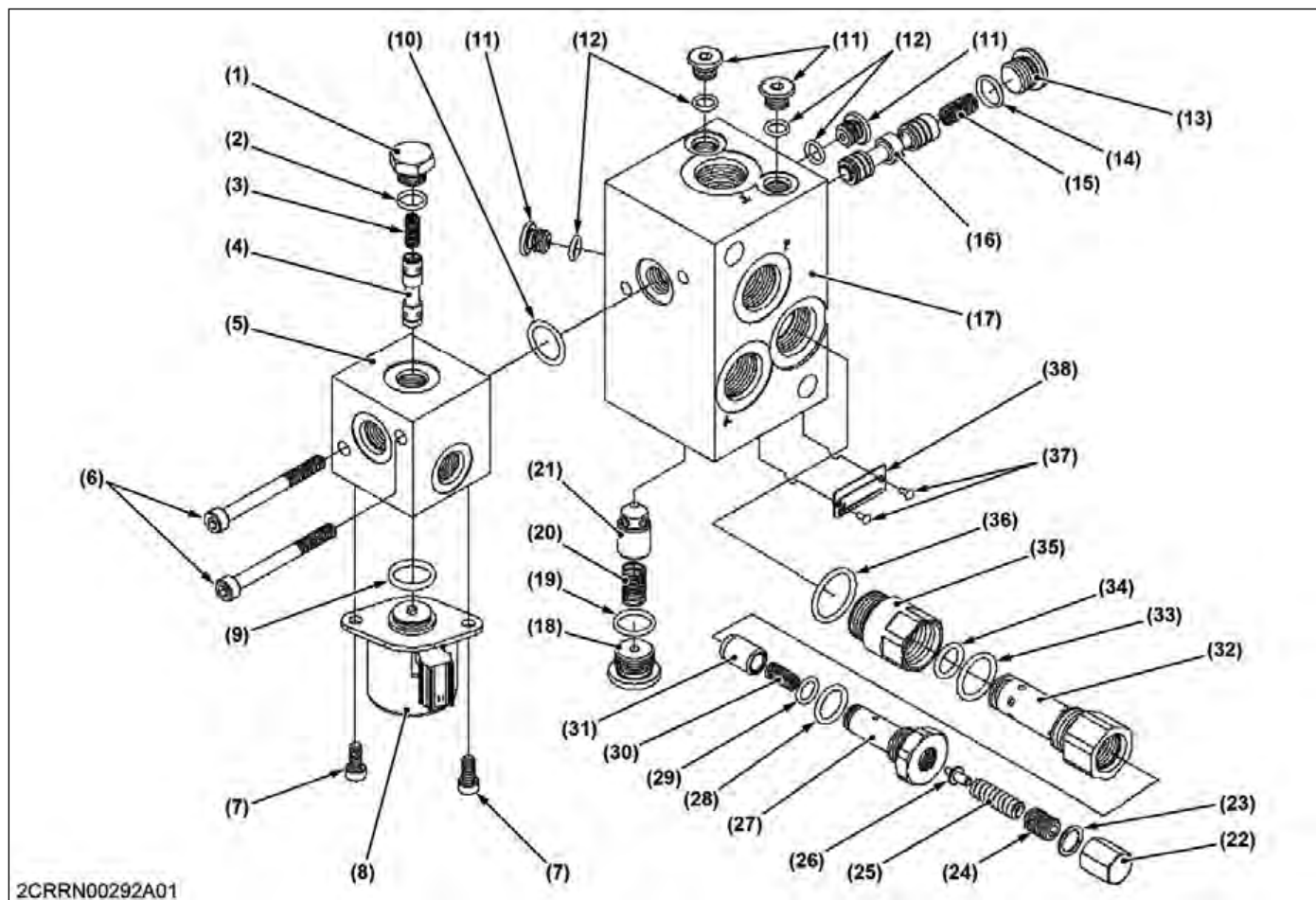
(3) High-flow solenoid valve	Approximately 5.2 kg Approximately 11.5 lbs
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Installing

Tightening torque

(4) Bolt	48.1 to 55.9 N · m 4.90 to 5.70 kgf · m 35.5 to 41.2 lbf · ft	—
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4.10.2 High-flow solenoid valve components



- (1) Plug
- (2) O-ring
- (3) Spring
- (4) Pilot spool
- (5) Body
- (6) Bolt (M5 ×60) ×2
- (7) Bolt (M5 ×10) ×2
- (8) Solenoid
- (9) O-ring
- (10) O-ring

- (11) Plug ×4
- (12) O-ring ×4
- (13) Plug
- (14) O-ring
- (15) Spring
- (16) Main spool
- (17) Body
- (18) Plug
- (19) O-ring
- (20) Spring

- (21) Plunger
- (22) Cap nut
- (23) Gasket
- (24) Adjustment screw
- (25) Spring
- (26) Needle
- (27) Housing
- (28) O-ring
- (29) O-ring
- (30) Spring

- (31) Poppet
- (32) Sleeve
- (33) O-ring
- (34) O-ring
- (35) Sleeve
- (36) O-ring
- (37) Screw ×2
- (38) Name plate

4.10.3 Disassembling and assembling the high-flow solenoid valve

■ IMPORTANT

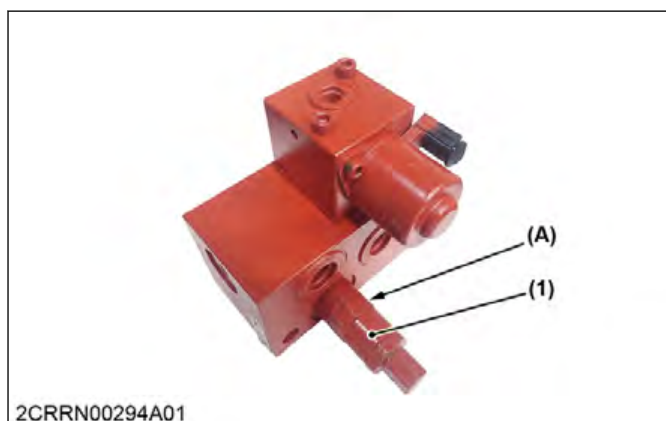
- Work at clean work space with clean tools and lubricant when assembling or disassembling hydraulic devices.
- Check for scratches or damages carefully on the sliding and mating surface for every part. They might cause oil leakage.
- Do not wipe parts with waste clothes or the like to avoid fiber waste contamination. Use air pressure when cleaning the parts.
- Do not reuse removed O-rings for assembly to avoid oil leakage.
- Apply lubricant or grease to every seal to avoid damage when assembling.
- After assembling, clean the outside of the hydraulic component.

Disassembling the high-flow solenoid valve

1. Remove the high-flow relief valve.

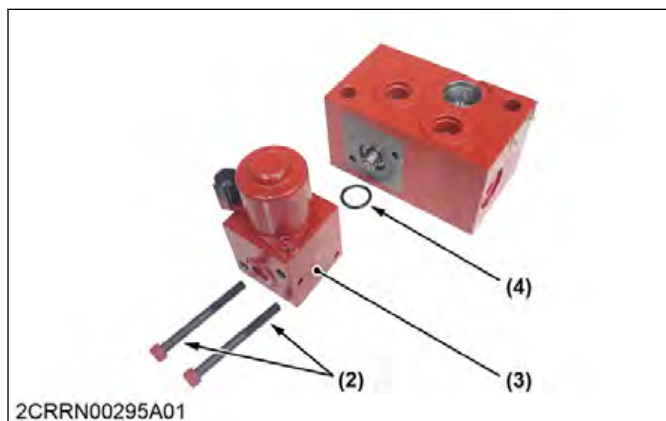
■ NOTE

- Hold the removing point with a spanner.



- (1) High-flow relief valve (A) Removing point

2. Remove the 2 cap bolts, the solenoid assembly, and the O-ring.

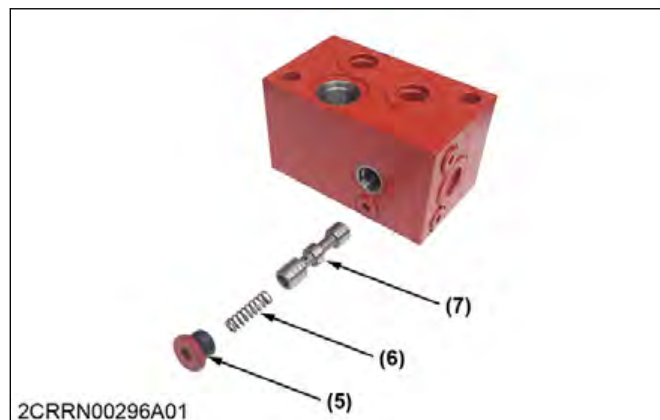


- (2) Cap bolt (M5 × 60) × 2 (4) O-ring
(3) Solenoid assembly

3. Remove the plug, the spring, and the main spool.

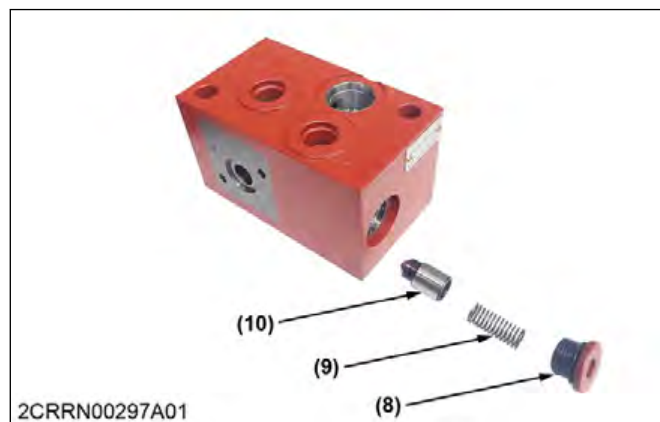
■ NOTE

- Be careful not to damage the main spool.



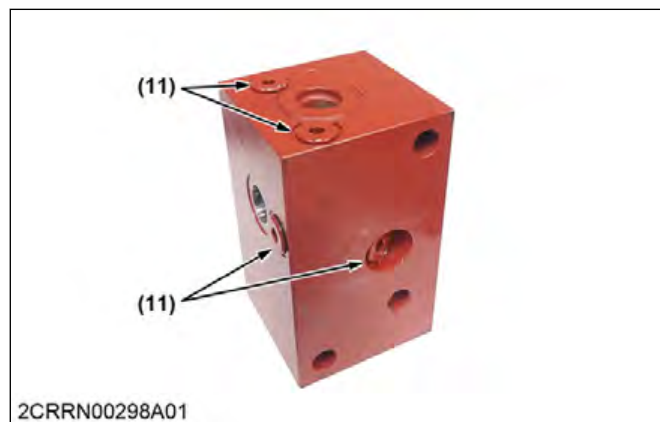
- (5) Plug (7) Main spool
(6) Spring

4. Remove the plug, the spring, and the plunger.



- (8) Plug (10) Plunger
(9) Spring

5. Remove the 4 plugs.



- (11) Plug × 4

Disassembling the solenoid assembly

1. Remove the 2 cap bolts.

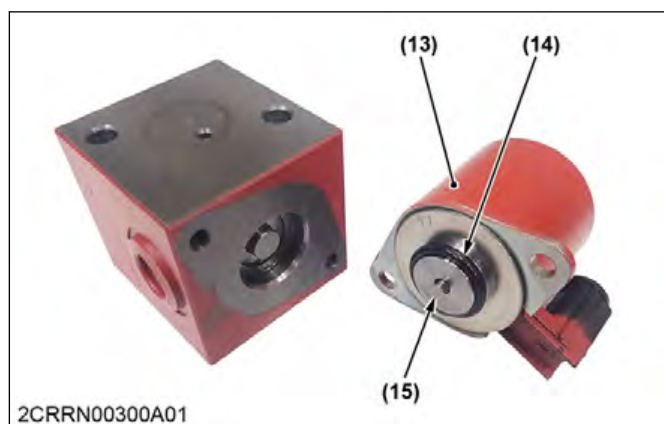


(12) Cap bolt (M5 × 10) × 2

2. Remove the solenoid and the O-ring.

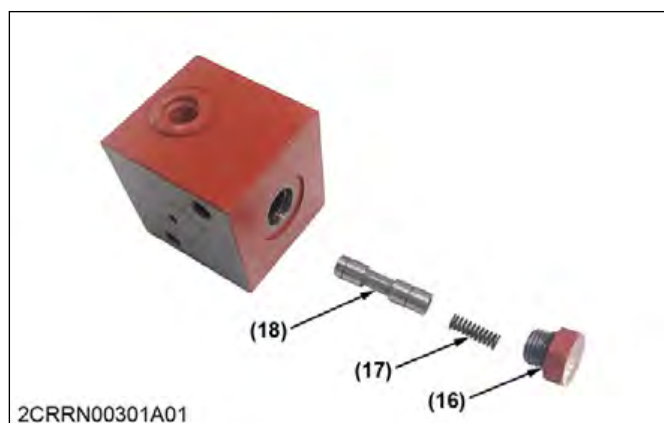
■ **NOTE**

- Be careful not to drop the push rod from the solenoid.
- When assembling, install the O-ring to the solenoid before installing the solenoid to the body.

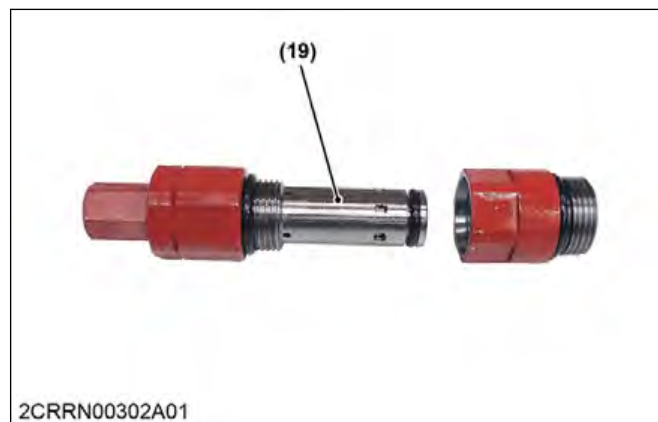
(13) Solenoid
(14) O-ring

(15) Push rod

3. Remove the plug, the spring, and the pilot spool.

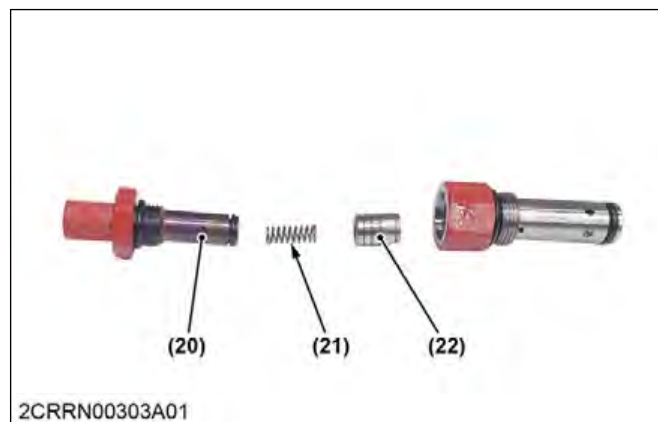
(16) Plug
(17) Spring

(18) Pilot spool



(19) Sleeve

2. Remove the housing, the spring, and the poppet.

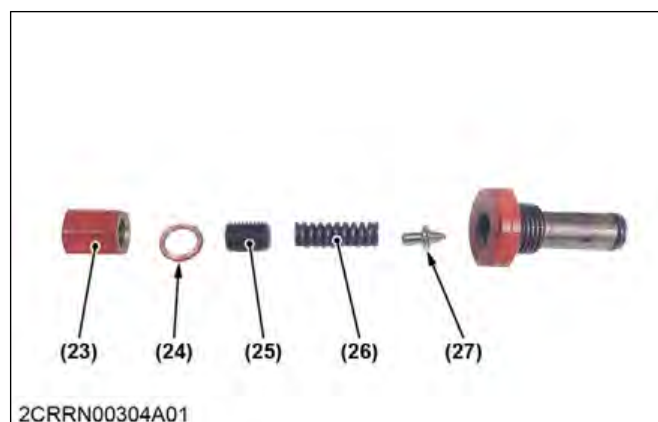
(20) Housing
(21) Spring

(22) Poppet

3. Remove the cap nut, the gasket, the adjustment screw, the spring, and the needle.

■ **NOTE**

- Do not reuse the used gasket.
- Do not remove the adjustment screw except when adjusting the relief pressure.

(23) Cap nut
(24) Gasket
(25) Adjustment screw(26) Spring
(27) Needle

Disassembling the high-flow relief valve

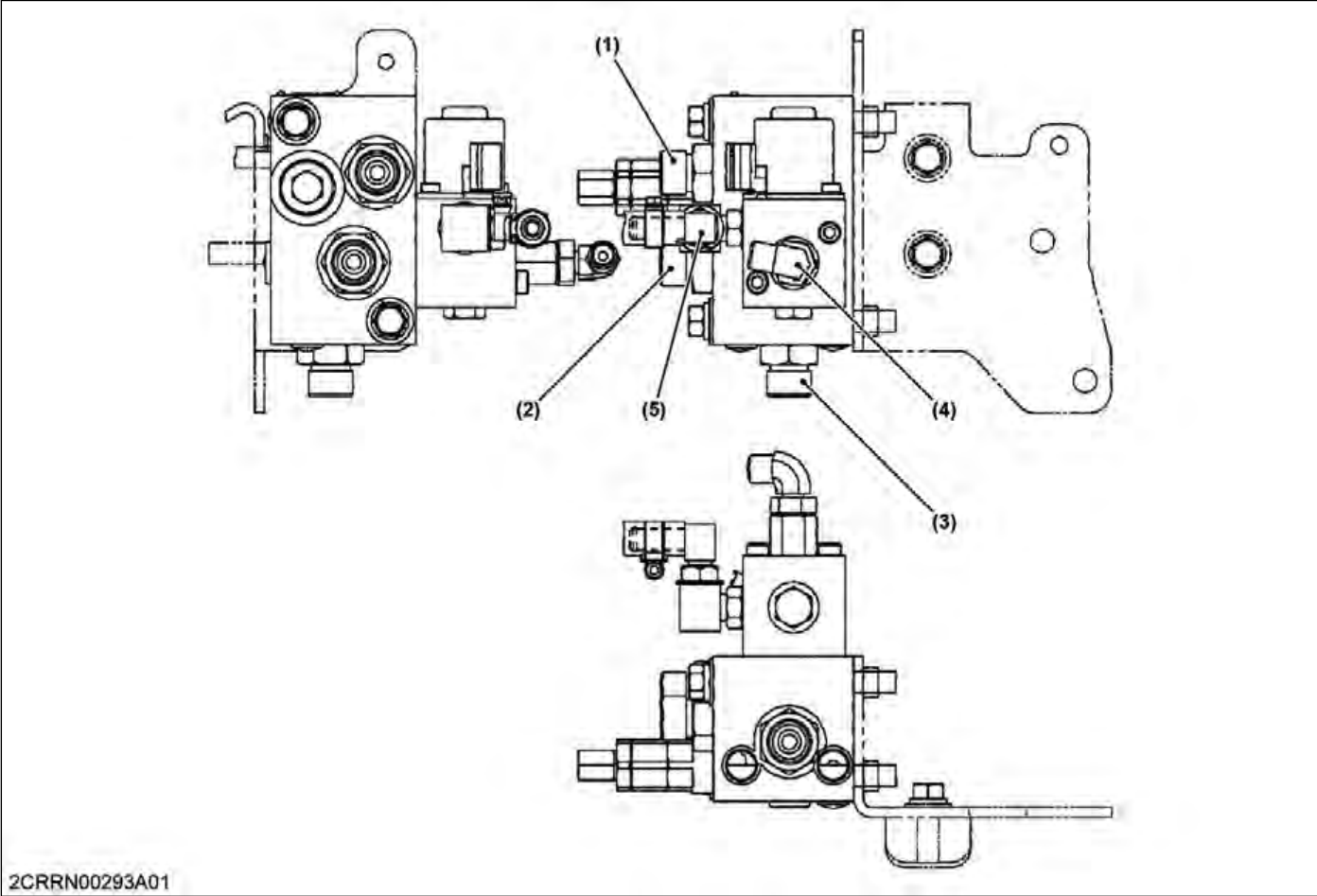
1. Remove the sleeve.

Assembling

Tightening torque

(1) High-flow relief valve	68.4 to 83.6 N · m 6.97 to 8.52 kgf · m 50.4 to 61.7 lbf · ft	—
(2) Cap bolt	9.7 to 11.9 N · m 0.99 to 1.21 kgf · m 7.15 to 8.78 lbf · ft	—
(5) Plug	28.3 to 34.5 N · m 2.89 to 3.52 kgf · m 20.9 to 25.4 lbf · ft	—
(8) Plug	43.6 to 53.4 N · m 4.45 to 5.45 kgf · m 32.2 to 39.4 lbf · ft	—
(11) Plug	8.8 to 10.8 N · m 0.90 to 1.10 kgf · m 6.49 to 7.97 lbf · ft	—
(12) Cap bolt	3.52 to 4.32 N · m 0.36 to 0.44 kgf · m 2.60 to 3.19 lbf · ft	—
(16) Plug	19.0 to 23.0 N · m 1.94 to 2.35 kgf · m 14.0 to 17.0 lbf · ft	—
(19) Sleeve	58.5 to 71.5 N · m 5.97 to 7.29 kgf · m 43.1 to 52.7 lbf · ft	—
(20) Housing	38.7 to 47.3 N · m 3.95 to 4.82 kgf · m 28.5 to 34.9 lbf · ft	—
(23) Cap nut	16.7 to 20.5 N · m 1.70 to 2.09 kgf · m 12.3 to 15.1 lbf · ft	—

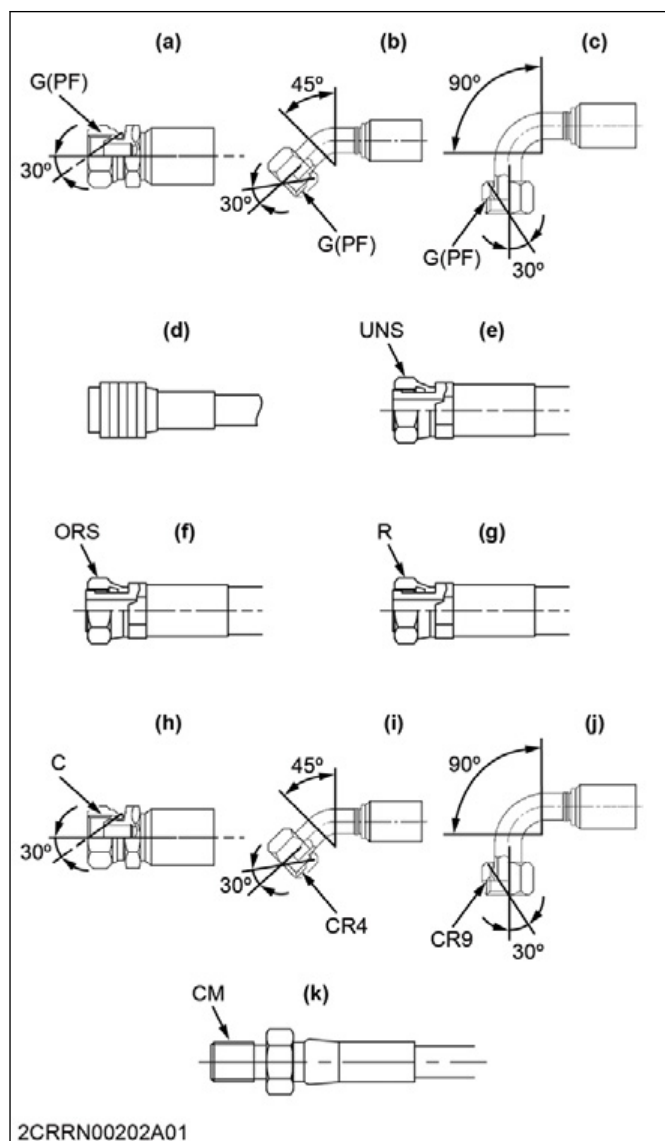
4.10.4 Installing adapters for the high-flow solenoid valve



No.	Port	Adapter size	Angle
(1)	A	G1/2-G1/2	—
(2)	P	G1/2-G1/2	—
(3)	T	G1/2-G1/2	—
(4)	PP	G1/4-G1/4	20°
(5)	Dr	G1/4-φ10 mm (φ0.4 in.)	—

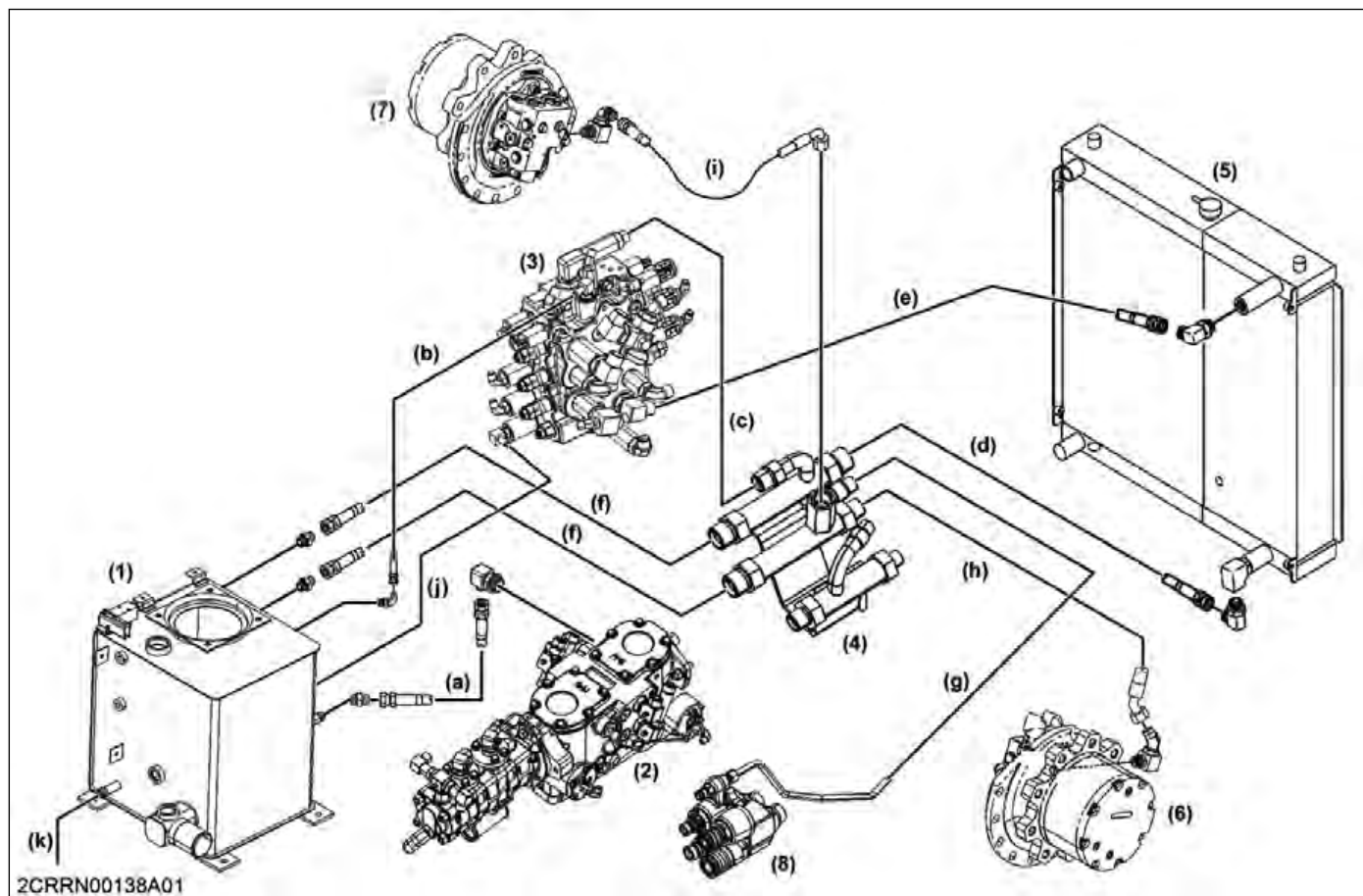
4.11 Hydraulic hose

4.11.1 Metal fittings of hydraulic hoses



- | | |
|--|---|
| (a) Straight type parallel pipe thread (Male 30° seat) | (f) ORS thread |
| (b) 45° type parallel pipe thread (Male 30° seat) | (g) R thread |
| (c) 90° type parallel pipe thread (Male 30° seat) | (h) C thread |
| (d) Quick hose coupling type | (i) 45° type CR4 thread (Male 30° seat) |
| (e) UNS thread | (j) 90° type CR9 thread (Male 30° seat) |
| | (k) Straight type CM thread |

4.11.2 Drain hose routing



(1) Oil tank
(2) HST pump

(3) Control valve
(4) Return pipe

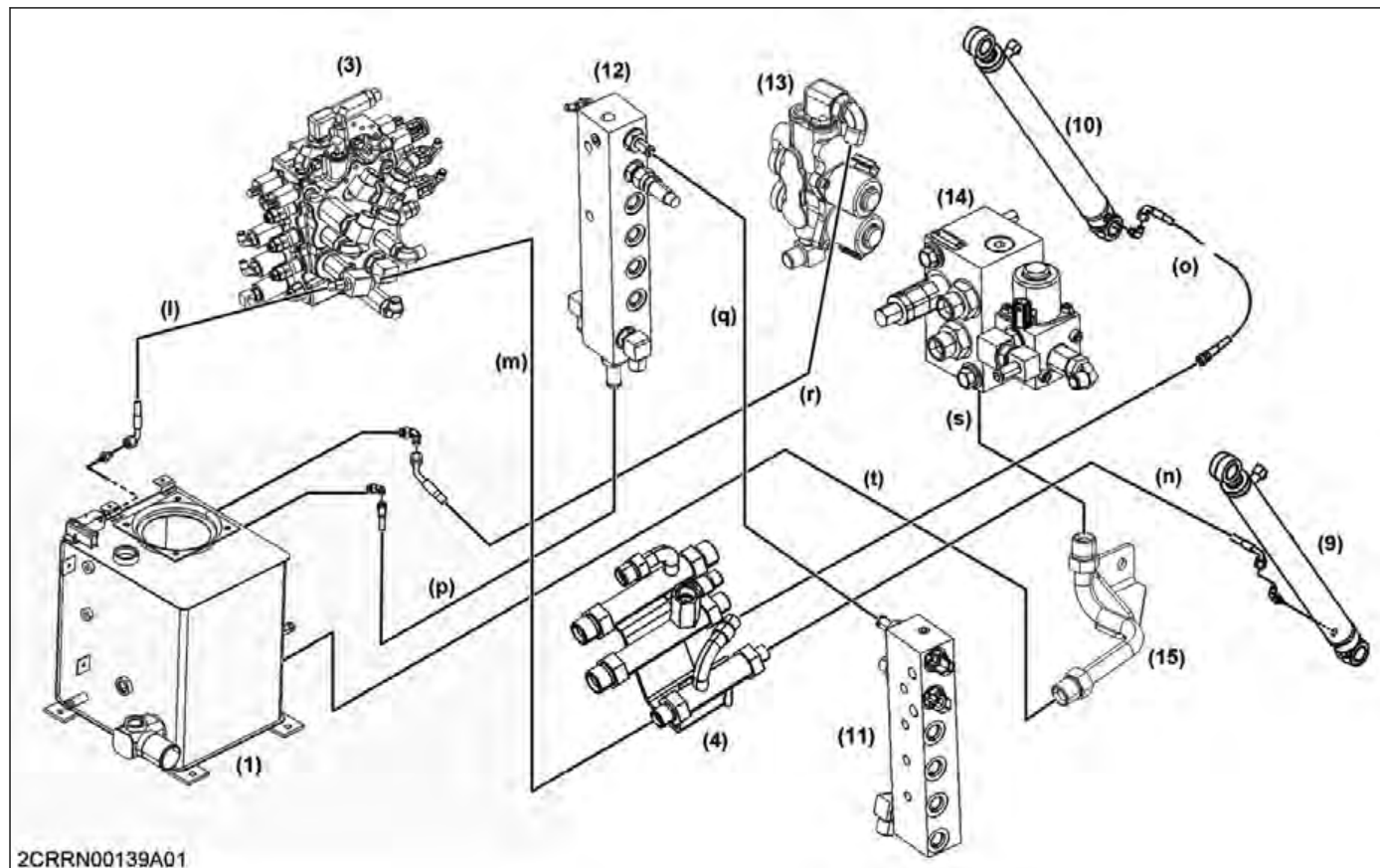
(5) Oil cooler
(6) HST motor LH

(7) HST motor RH
(8) AUX coupler

	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(a)	Oil tank - HST pump (L2)	375 mm 14.8 in.	—	—	—	—
(b)	Oil tank - C/V (Y)	350 mm 13.8 in.	—	—	—	—
(c)	C/V (T) -Return pipe	615 mm 24.2 in.	Orange - None	G1/2 Straight	G1/2 Straight	—
(d)	Return pipe - Oil cooler (OUT)	930 mm 36.6 in.	—	G3/4 Straight	G3/4 Straight	Vinyl tube
(e)	Oil cooler (IN) - C/V (T1)	2090 mm 82.3 in.	—	G3/4 Straight	G3/4 Straight	Sleeve
(f)	Oil tank - Return pipe	750 mm 29.5 in.	Orange - None	G3/4 Straight	G3/4 Straight	Vinyl tube
(g)	Return pipe - AUX coupler (Dr)	3915 mm 154.1 in.	Red - Pink	G3/8 Straight	G3/8 Straight	Sleeve
(h)	Return pipe - HST motor LH (Dr)	1690 mm 66.5 in.	—	G1/2 90°	G1/2 Straight	Sleeve
(i)	Return pipe - HST motor RH (Dr)	400 mm 15.7 in.	None - Orange	G1/2 90°	G1/2 Straight	—

(Continued)

	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(j)	C/V (Dr) - Oil tank	265 mm 10.4 in.	—	—	—	—
(k)	Oil tank (Dr) - Drain	940 mm 37.0 in.	—	—	—	Colgate tube



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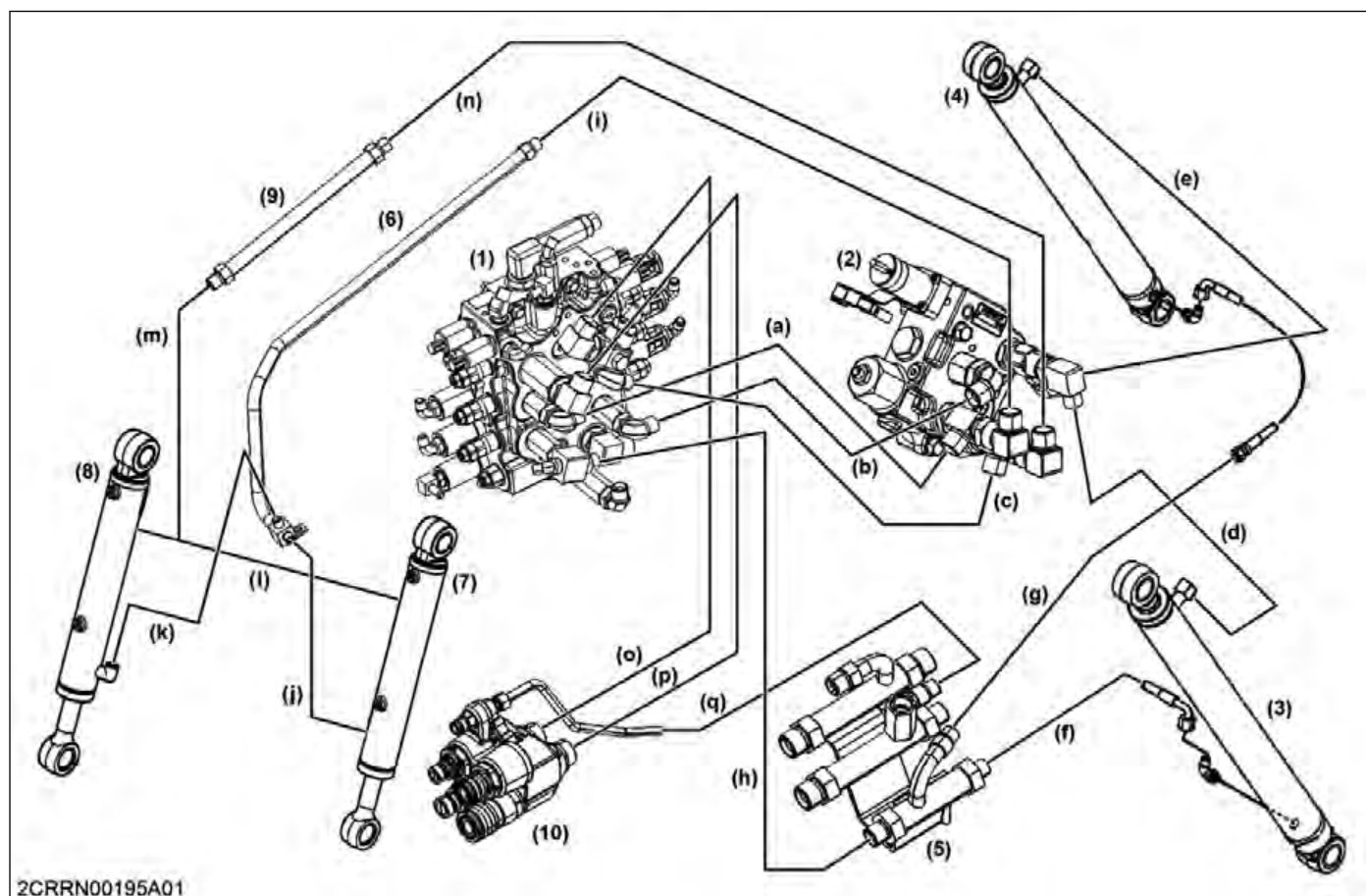
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|-------------------|---------------------------|---|-------------------------------|
| (1) Oil tank | (9) Lift arm cylinder LH | (12) Relay block RH | (14) High-flow solenoid valve |
| (3) Control valve | (10) Lift arm cylinder RH | (13) Hydraulic quick hitch solenoid valve | (15) High-flow relay pipe |
| (4) Return pipe | (11) Relay block LH | | |

	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(l)	Oil tank - C/V (A1)	510 mm 20.1 in.	Orange - None	G1/4 Straight	G1/4 Straight	Vinyl tube
(m)	C/V (A1) - Return pipe	560 mm 22.0 in.	—	G1/2 Straight	G1/2 Straight	Sleeve
(n)	Return pipe -Lift arm cylinder LH (bottom)	1360 mm 53.5 in.	None - Light blue	G3/8 Straight	G3/8 90°	Sleeve
(o)	Return pipe - Lift arm cylinder RH (bottom)	685 mm 27.0 in.	None - Orange	G3/8 Straight	G3/8 90°	—
(p)	Oil tank - Relay block LH	970 mm 38.2 in.	—	—	—	Vinyl tube
(q)	Oil tank - Relay block RH	465 mm 18.3 in.	—	—	—	—

(Continued)

	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(r)	Oil tank - Hydraulic quick hitch solenoid valve (T)	1070 mm 42.1 in.	—	G3/8 Straight	G3/8 Straight	Vinyl tube
(s)	Oil tank - Hydraulic quick hitch solenoid valve (T)	435 mm 17.1 in.	None - Pink	G1/2 Straight	G1/2 Straight	—
(t)	Oil tank - High-flow relay pipe	800 mm 31.5 in.	—	G1/2 Straight	G1/2 Straight	Sleeve

4.11.3 Front hose routing



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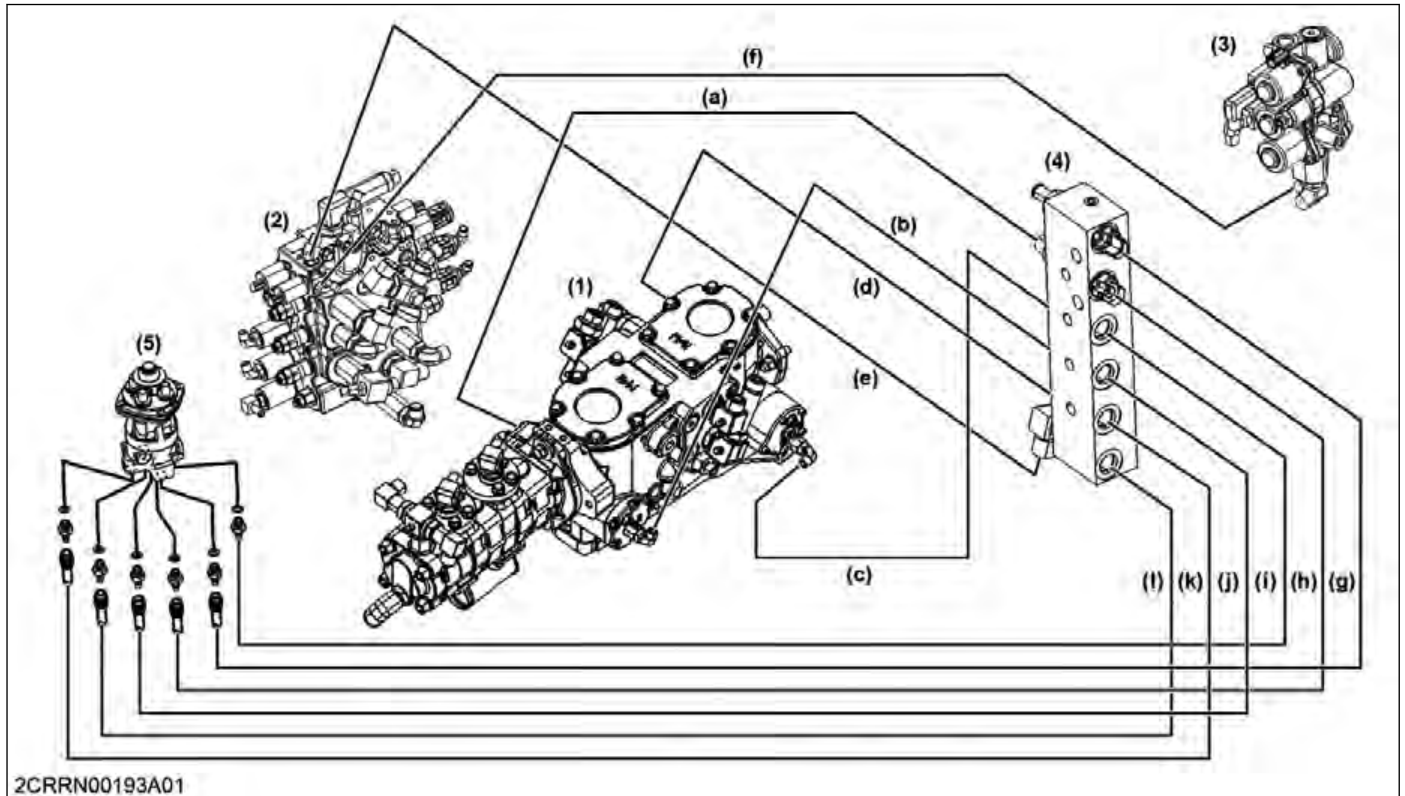
- | | | | |
|----------------------------------|--------------------------------|-----------------------------------|------------------|
| (1) Control valve | (4) Lift arm cylinder RH | (7) Bucket cylinder LH | (10) AUX coupler |
| (2) Self-leveling solenoid valve | (5) Return pipe | (8) Bucket cylinder RH | |
| (3) Lift arm cylinder LH | (6) Bucket cylinder (rod) pipe | (9) Bucket cylinder (bottom) pipe | |

	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(a)	C/V (A2) - Self-leveling solenoid valve (C)	500 mm 19.7 in.	Red - None	G1/2 Straight	G1/2 45°	—
(b)	C/V (B1) - Self-leveling solenoid valve (B)	440 mm 17.3 in.	—	G1/2 Straight	G1/2 Straight	—
(c)	C/V (B2) - Self-leveling solenoid valve (D)	470 mm 18.5 in.	Orange - None	G1/2 Straight	G1/2 45°	—
(d)	Self-leveling solenoid valve (A) - Lift arm cylinder LH (rod)	2345 mm 92.3 in.	White - Light blue	G3/8 Straight	G3/8 Straight	Sleeve
(e)	Self-leveling solenoid valve (A) - Lift arm cylinder RH (rod)	1555 mm 61.2 in.	None - Orange	G3/8 Straight	G3/8 Straight	Sleeve
(f)	Return pipe - Lift arm cylinder LH (bottom)	1360 mm 53.5 in.	Orange - Light blue	G3/8 Straight	G3/8 90°	Sleeve

(Continued)

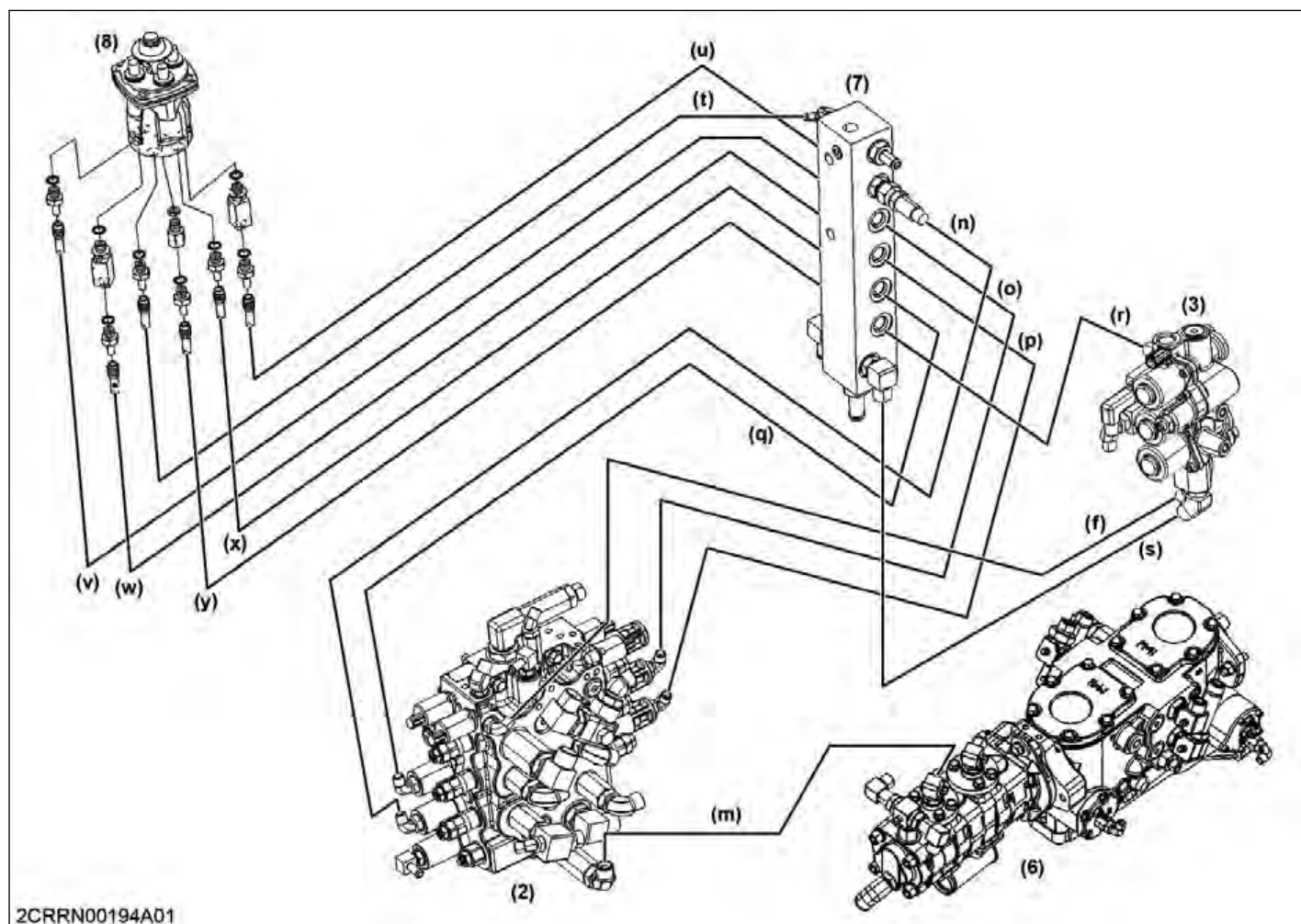
	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(g)	Return pipe - Lift arm cylinder RH (bottom)	685 mm 27.0 in.	None - Orange	G3/8 Straight	G3/8 90°	—
(h)	C/V (A1) - Return pipe	560 mm 22.0 in.	—	G1/2 Straight	G1/2 Straight	Sleeve
(i)	Self-leveling solenoid valve (C) - Bucket cylinder (rod) pipe	3000 mm 118.1 in.	White - None	G1/2 Straight	G1/2 Straight	Sleeve
(j)	Bucket cylinder (rod) pipe - Bucket cylinder LH (rod)	1100 mm 43.3 in.	Orange - Orange	G3/8 Straight	G3/8 Straight	Sleeve
(k)	Bucket cylinder (rod) pipe - Bucket cylinder RH (rod)	515 mm 20.3 in.	—	G3/8 Straight	G3/8 Straight	Sleeve
(l)	Bucket cylinder (bottom) pipe - Bucket cylinder LH (bottom)	1210 mm 47.6 in.	—	G3/8 Straight	G3/8 Straight	Sleeve
(m)	Bucket cylinder (bottom) pipe - Bucket cylinder RH (bottom)	425 mm 16.7 in.	—	G1/2 Straight	G1/2 Straight	Sleeve
(n)	Self-leveling solenoid valve (D) - Bucket cylinder (bottom) pipe	3100 mm 122.0 in.	White - Orange	G1/2 Straight	G1/2 Straight	Sleeve
(o)	C/V (B3) - AUX coupler (male)	3570 mm 140.6 in.	Orange - None	G3/4 Straight	G3/4 Straight	Sleeve
(p)	C/V (A3) - AUX coupler (female)	3535 mm 139.2 in.	Orange - Orange	G3/4 Straight	G3/4 Straight	Sleeve
(q)	Return pipe - AUX coupler (Dr)	3895 mm 153.3 in.	Red - Pink	G3/8 Straight	G3/8 Straight	Sleeve

4.11.4 Pilot hose routing



- | | | |
|-------------------|--------------------|--------------------------|
| (1) HST pump | (3) Unload valve | (5) Travel control valve |
| (2) Control valve | (4) Relay block LH | |

	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(a)	HST pump (M14) - Relay LH (PV4)	1250 mm 49.2 in.	Orange - Pink	G1/4 Straight	G1/4 Straight	Vinyl tube
(b)	HST pump (M15) - Relay LH (PV2)	1055 mm 41.5 in.	Orange - Yellow	G1/4 Straight	G1/4 Straight	—
(c)	HST pump (M4) - Relay LH (PV3)	1290 mm 50.8 in.	Orange - Blue	G1/4 Straight	G1/4 Straight	Vinyl tube
(d)	HST pump (M5) - Relay LH (PV1)	900 mm 35.4 in.	Orange - Green	G1/4 Straight	G1/4 Straight	—
(e)	C/V (Pp) - Relay block LH (PVP)	1130 mm 44.5 in.	None - Gray	G3/8 Straight	G3/8 Straight	—
(f)	C/V (X2) - Unload valve (P)	1270 mm 50.0 in.	Red - Orange	G1/4 Straight	G1/4 Straight	Vinyl tube
(g)	Relay block LH (T) - P/VLH (T)	1425 mm 56.1 in.	Red - Red	Quick coupler	Quick coupler	—
(h)	Relay block LH (4) - P/VLH (1)	1400 mm 55.1 in.	Pink - Pink	Quick coupler	Quick coupler	—
(i)	Relay block LH (3) - P/VLH (4)	1400 mm 55.1 in.	Blue - Blue	Quick coupler	Quick coupler	—
(j)	Relay block LH (2) - P/VLH (3)	1430 mm 56.3 in.	Yellow - Yellow	Quick coupler	Quick coupler	—
(k)	Relay block LH (1) - P/VLH (2)	1490 mm 58.7 in.	Green - Green	Quick coupler	Quick coupler	—
(l)	Relay block LH (P) - P/VLH (P)	1470 mm 57.9 in.	Gray - Gray	Quick coupler	Quick coupler	—



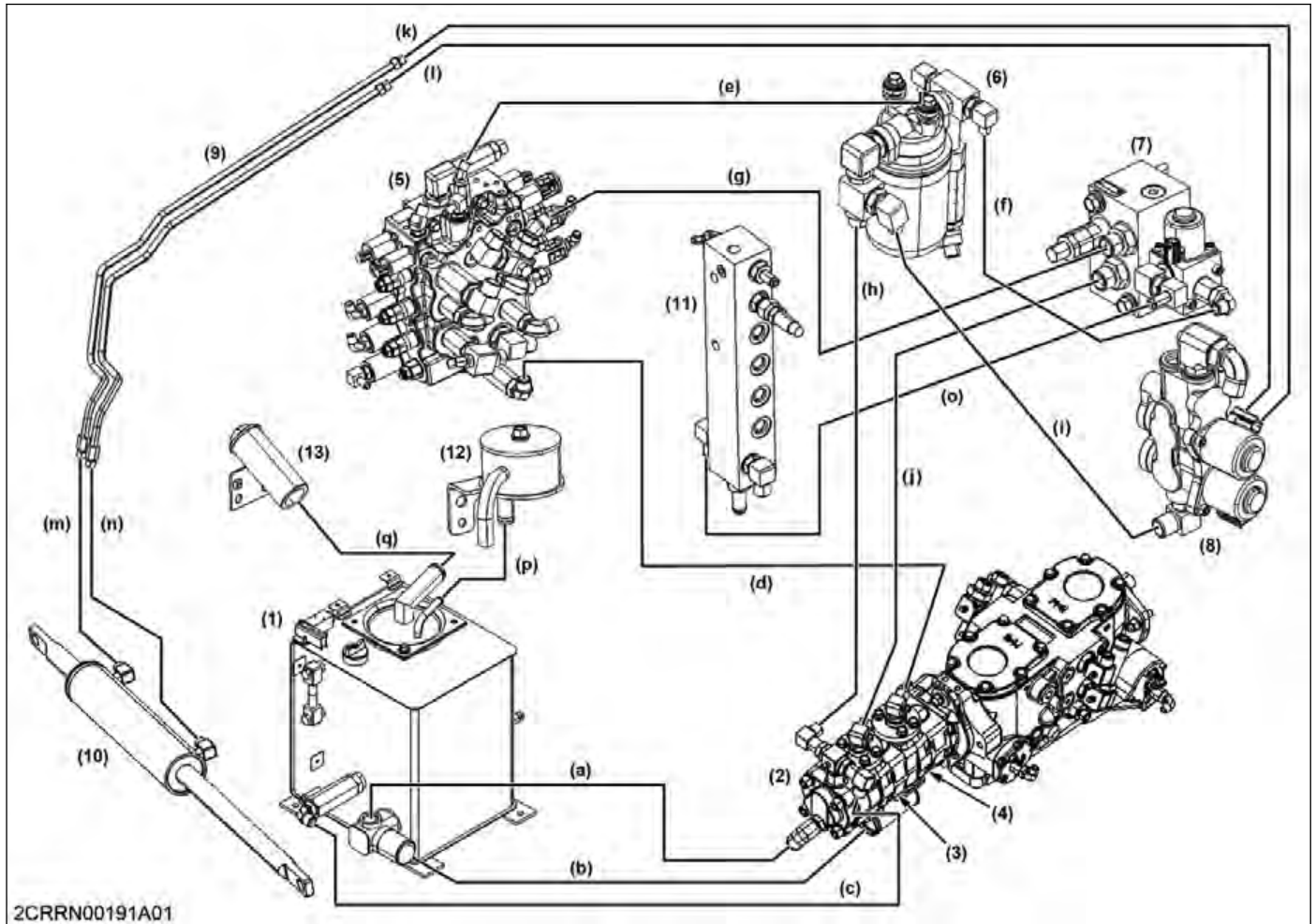
- (2) Control valve (6) Main pump (8) Front attachment control valve
(3) Unload valve (7) Relay block RH

	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(f)	C/V (X2) - Unload valve (P)	1270 mm 50.0 in.	Red - Orange	G1/4 Straight	G1/4 Straight	Vinyl tube
(m)	Main pump (P1) - C/V (P1)	430 mm 16.9 in.	Orange - None	G1/2 Straight	G1/2 Straight	—
(n)	C/V (Pa1) - Relay block RH (4)	1370 mm 53.9 in.	None - Blue	G1/4 Straight	G1/4 Straight	—
(o)	C/V (Pb2) - Relay block RH (3)	955 mm 37.6 in.	None - Yellow	G1/4 straight	G1/4 straight	—
(p)	C/V (Pb1) - Relay block RH (2)	985 mm 38.8 in.	None - Green	G1/4 straight	G1/4 straight	Vinyl tube
(q)	C/V (Pa2) - Relay block RH (1)	1150 mm 45.3 in.	None - Pink	G1/4 straight	G1/4 straight	—
(r)	Unload valve (A3) - Relay block RH (P)	1115 mm 43.9 in.	None - Gray	G1/4 90°	G1/4 straight	—
(s)	Unload valve (T) - Relay block RH (Dr)	900 mm 35.4 in.	Orange - Gray	G3/8 straight	G3/8 straight	—

(Continued)

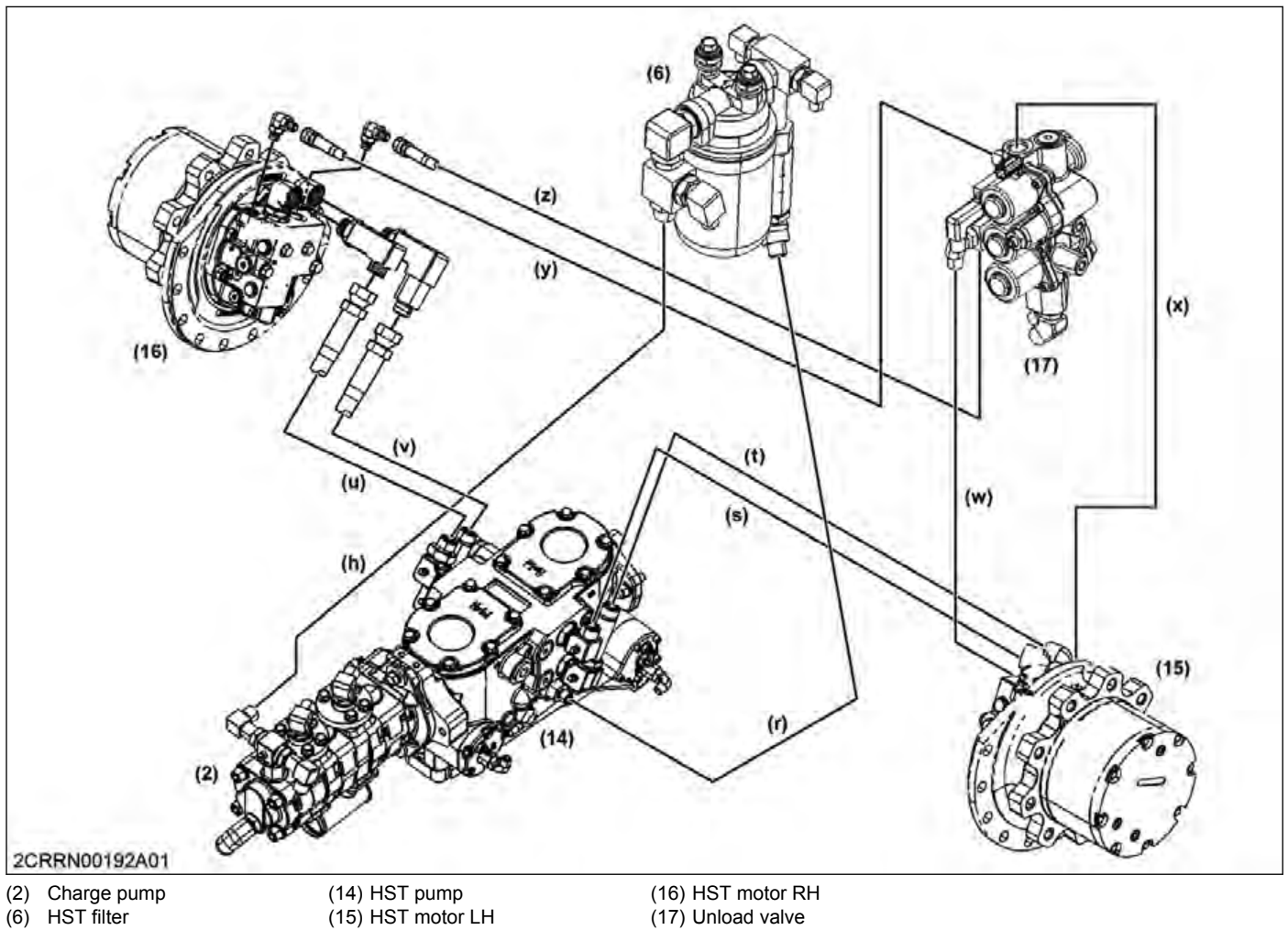
	Point of use	Hose				Guard
		Length	Tape color	Metal fittings LH	Metal fittings RH	
(t)	Relay block RH (T) - P/VRH (T)	1510 mm 59.5 in.	Red - Red	Quick coupler	Quick coupler	—
(u)	Relay RH (4) - P/VRH (4)	1430 mm 56.3 in.	Blue - Blue	Quick coupler	Quick coupler	—
(v)	Relay block RH (3) - P/VRH (3)	1580 mm 62.2 in.	Yellow - Yellow	Quick coupler	Quick coupler	—
(w)	Relay block RH (2) - P/VRH (2)	1550 mm 61.0 in.	Green - Green	Quick coupler	Quick coupler	—
(x)	Relay block RH (1) - P/VRH (1)	1620 mm 63.8 in.	Pink - Pink	Quick coupler	Quick coupler	—
(y)	Relay block RH (P) - P/VRH (P)	1630 mm 64.2 in.	Gray - Gray	Quick coupler	Quick coupler	—

4.11.5 Suction hose routing



- | | | | |
|--------------------|------------------------------|-------------------------------------|----------------------|
| (1) Oil tank | (5) Control valve | (8) Hydraulic quick hitch solenoid | (11) Relay RH |
| (2) Charge pump | (6) HST filter | valve | (12) Breather filter |
| (3) High-flow pump | (7) High-flow solenoid valve | (9) Relay pipe × 2 | (13) Oil filler pipe |
| (4) Main pump | | (10) Hydraulic quick hitch cylinder | |

	Point of use		Hose				Guard
			Length	Tape color	Metal fittings LH	Metal fittings RH	
(a)	Oil tank - Charge pump (P3)		Molded hose	—	—	—	—
(b)	Oil tank - Main pump (P1)		Molded hose	—	—	—	—
(c)	Charge pump (P3) - Oil tank	High-flow specification	580 mm 22.8 in.	Orange - None	G1/2 Straight	G1/2 Straight	Vinyl tube
		Normal flow specification	550 mm 21.7 in.				
(d)	Main pump (P1) - C/V (P1)		440 mm 17.3 in.	Orange - None	G1/2 Straight	G1/2 Straight	—
(e)	HST filter (OUT) - C/V (X)		660 mm 26.0 in.	Orange - Red	G1/4 Straight	G1/4 Straight	Vinyl tube
(f)	HST filter (OUT) - High-flow solenoid valve (Pp)		480 mm 18.9 in.	Brown - Orange	G1/4 Straight	G1/4 Straight	Vinyl tube
(g)	High-flow solenoid valve (A) - C/V (B3)		570 mm 22.4 in.	—	G1/2 90°	G1/2 Straight	—
(h)	Charge pump (P3) - HST filter (IN)	High-flow hydraulic quick hitch specification	1070 mm 42.1 in.	White - Brown	G1/2 Straight	G1/2 Straight	—
		High-flow mechanical quick hitch specification	1140 mm 44.9 in.				
		Normal flow hydraulic quick hitch specification	960 mm 37.8 in.				
		Normal flow mechanical quick hitch specification	1025 mm 40.4 in.				
(i)	Hydraulic quick hitch solenoid valve (P) - HST filter (IN)		655 mm 25.8 in.	None - Brown	G3/8 Straight	G3/8 Straight	—
(j)	High-flow pump (P2) - High-flow solenoid valve (P)		1085 mm 42.7 in.	Orange - None	G1/2 Straight	G1/2 Straight	—
(k)	Hydraulic quick hitch solenoid valve (A) - Relay pipe		2635 mm 103.7 in.	None - Orange	G3/8 Straight	G3/8 Straight	Sleeve
(l)	Hydraulic quick hitch solenoid valve (B) - Relay pipe		2595 mm 102.2 in.	Gray - Gray	G3/8 Straight	G3/8 Straight	Sleeve
(m)	Relay pipe - Hydraulic quick hitch cylinder (bottom)		690 mm 27.2 in.	Black - None	G3/8 Straight	G3/8 90°	Sleeve
(n)	Relay pipe - Hydraulic quick hitch cylinder (rod)		860 mm 33.9 in.	Orange - None	G3/8 Straight	G3/8 Straight	Sleeve
(o)	High-flow pump (Dr) - Relay RH		250 mm 9.84 in.	—	—	—	—
(p)	Oil tank - Breather filter		500 mm 19.7 in.	—	—	—	—
(q)	Oil tank - Oil filler pipe		Molded hose	—	—	—	—



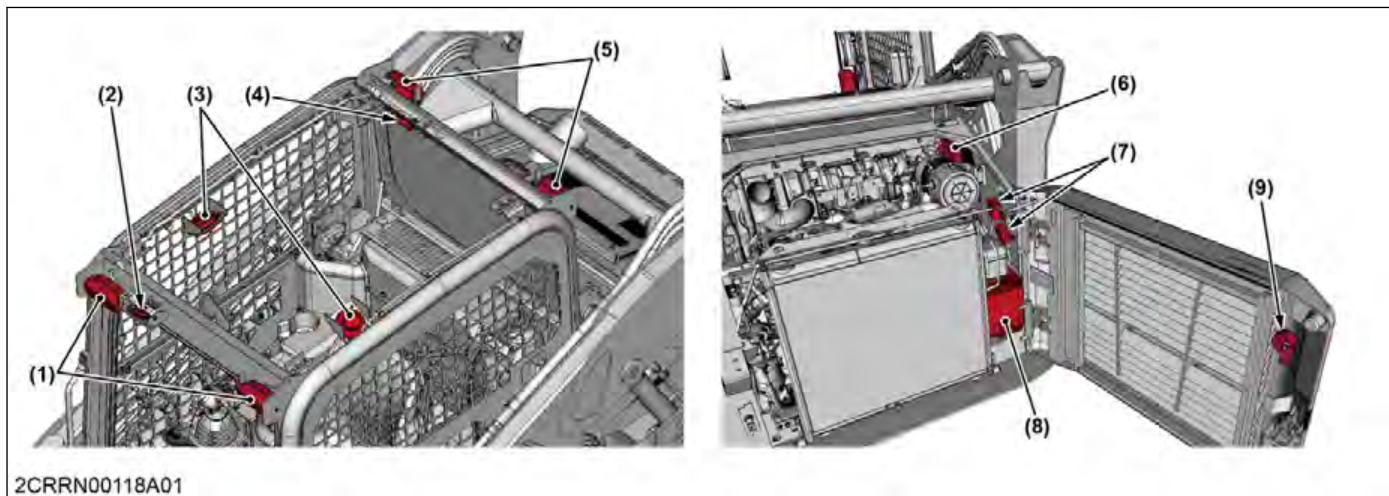
	Point of use		Hose				Guard
			Length	Tape color	Metal fittings LH	Metal fittings RH	
(h)	Charge pump (P3) - HST filter (IN)	High-flow hydraulic quick hitch specification	1070 mm 42.1 in.	White - Brown	G1/2 Straight	G1/2 Straight	—
		High-flow mechanical quick hitch specification	1140 mm 44.9 in.				
		Normal flow hydraulic quick hitch specification	960 mm 37.8 in.				
		Normal flow mechanical quick hitch specification	1025 mm 40.4 in.				
(r)	HST filter (OUT) - HST pump (M6)		1060 mm 41.7 in.	Brown - Orange	G3/8 Straight	G3/8 90°	—
(s)	HST pump (A) - HST motor LH (B)		530 mm 20.9 in.	Light blue - None	1-14UNS Straight	1-14UNS Straight	—
(t)	HST pump (B) - HST motor LH (A)		485 mm 19.1 in.	Light blue - None	1-14UNS Straight	1-14UNS Straight	—
(u)	HST pump (C) - HST motor RH (A)		540 mm 21.3 in.	Orange - None	1-14UNS Straight	1-14UNS Straight	—
(v)	HST pump (D) - HST motor RH (B)		520 mm 20.5 in.	Orange - None	1-14UNS Straight	1-14UNS Straight	—
(w)	Unload valve (A1) - HST motor LH (Pb)		550 mm 21.7 in.	Green - None	G1/4 Straight	G1/4 Straight	—
(x)	Unload valve (A2) - HST motor LH (P2)		590 mm 23.2 in.	Green - Orange	G1/4 Straight	G1/4 Straight	—
(y)	Unload valve (A2) - HST motor RH (P2)		1315 mm 51.8 in.	Green - None	G1/4 Straight	G1/4 90°	—
(z)	Unload valve (A1) - HST motor RH (Pb)		1400 mm 55.1 in.	Green - None	G1/4 Straight	G1/4 Straight	—

7. ELECTRICAL SYSTEM

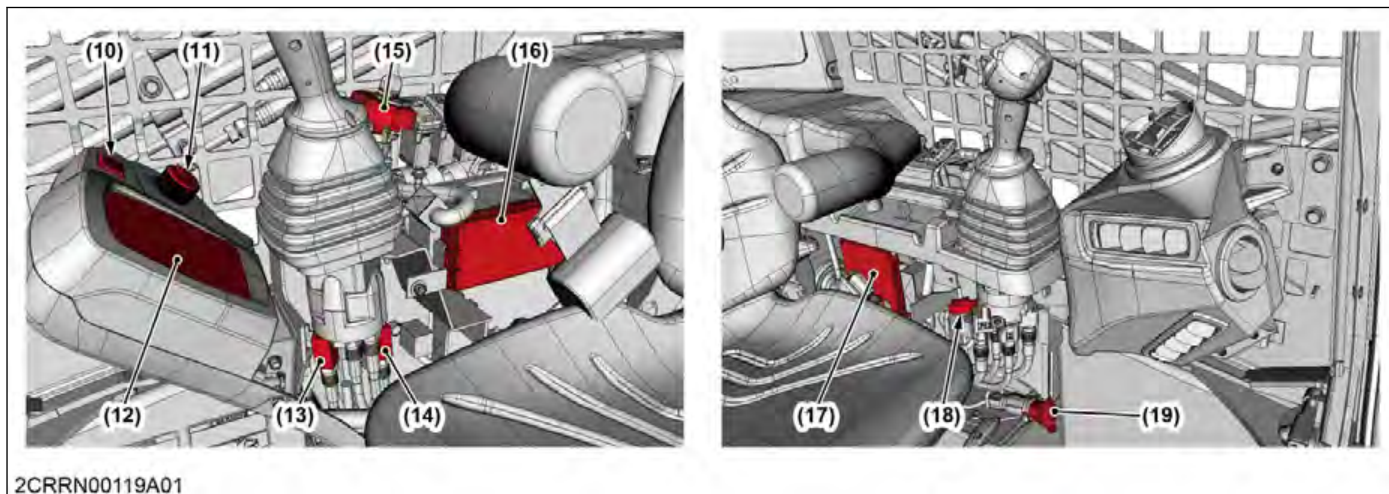
MECHANISM

1. Electrical device

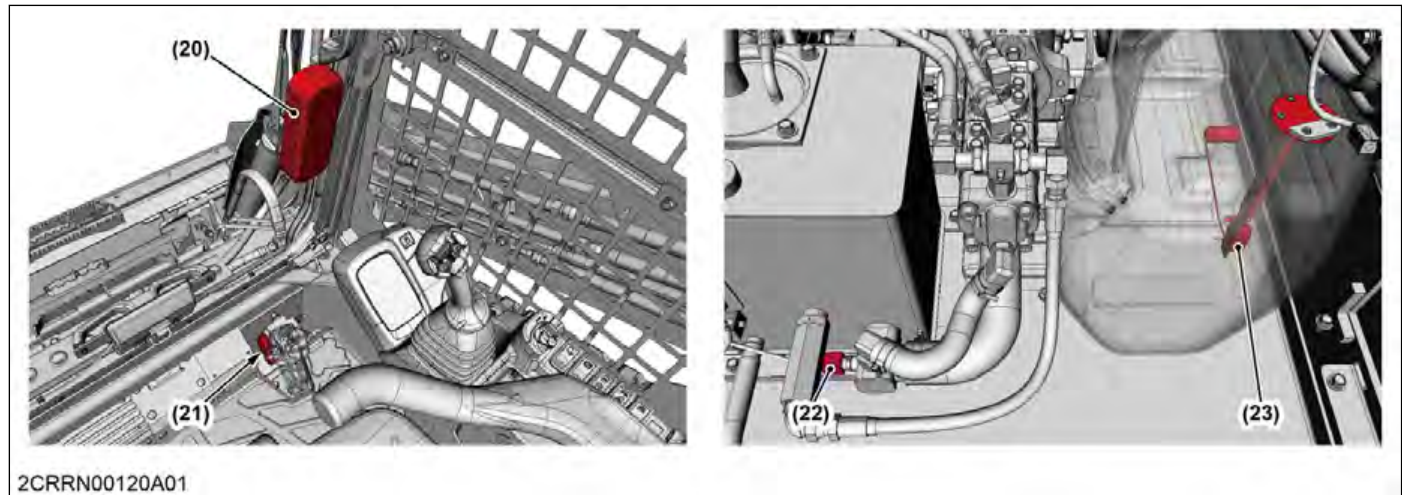
1.1 Electrical device layout



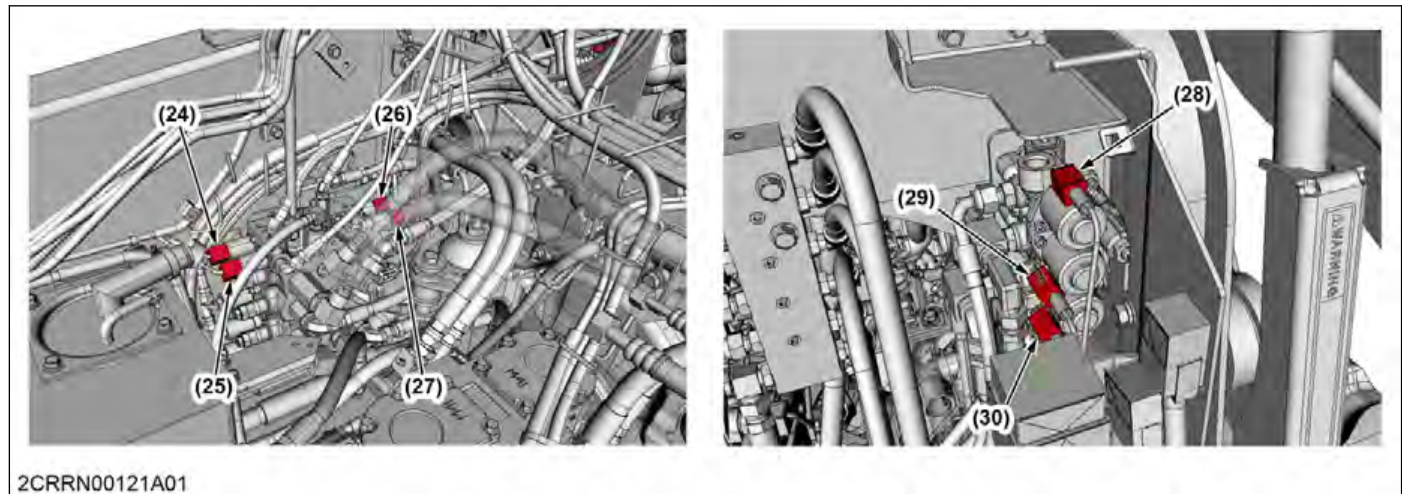
- | | | |
|----------------------|---------------------|--------------------|
| (1) Front work light | (4) Room light | (7) Slow blow fuse |
| (2) Horn | (5) Rear work light | (8) Battery |
| (3) Speaker | (6) Relay box | (9) Back-up buzzer |



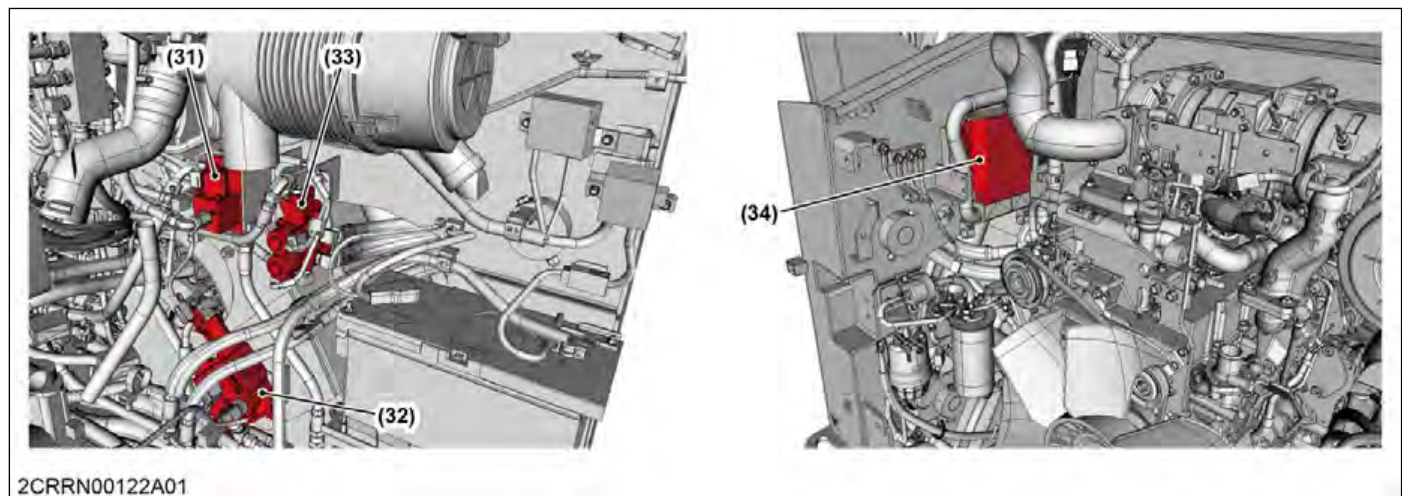
- | | | | |
|-------------------------------|---|--|--|
| (10) Air cleaner warning lamp | (13) Lift arm lowering pressure switch (NO) | (14) Lift arm lifting pressure switch (NC) | (17) Main ECU |
| (11) Accelerator dial | | (15) Starter switch | (18) Back-up buzzer pressure switch (NO) |
| (12) Meter panel | | (16) Relay and fuse box | (19) Cigarette socket |



(20) Wiper motor
(21) Potentiometer
(22) Hydraulic oil temperature sensor
(23) Fuel sensor

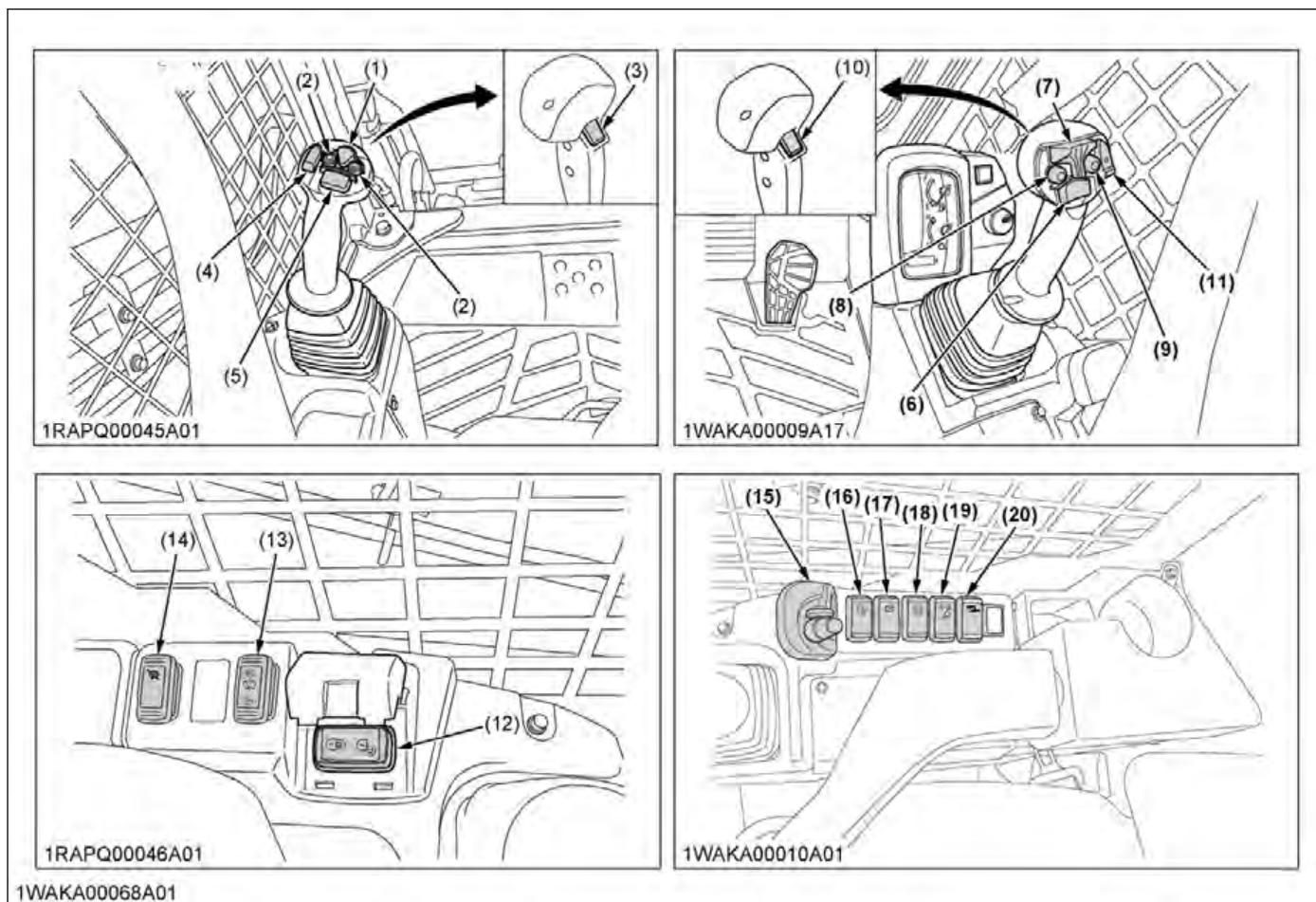


(24) Proportional solenoid 1 (AUX female)
(25) Proportional solenoid 2 (anti-stall)
(26) Proportional solenoid 3 (AUX male)
(27) Proportional solenoid 4 (float)
(28) Solenoid valve 1 (hydraulic unlock)
(29) Solenoid valve 2 (travel speed shift)
(30) Solenoid valve 3 (parking brake)



(31) High-flow solenoid
(32) Self-leveling solenoid
(33) Hydraulic quick hitch solenoid
(34) Engine ECU

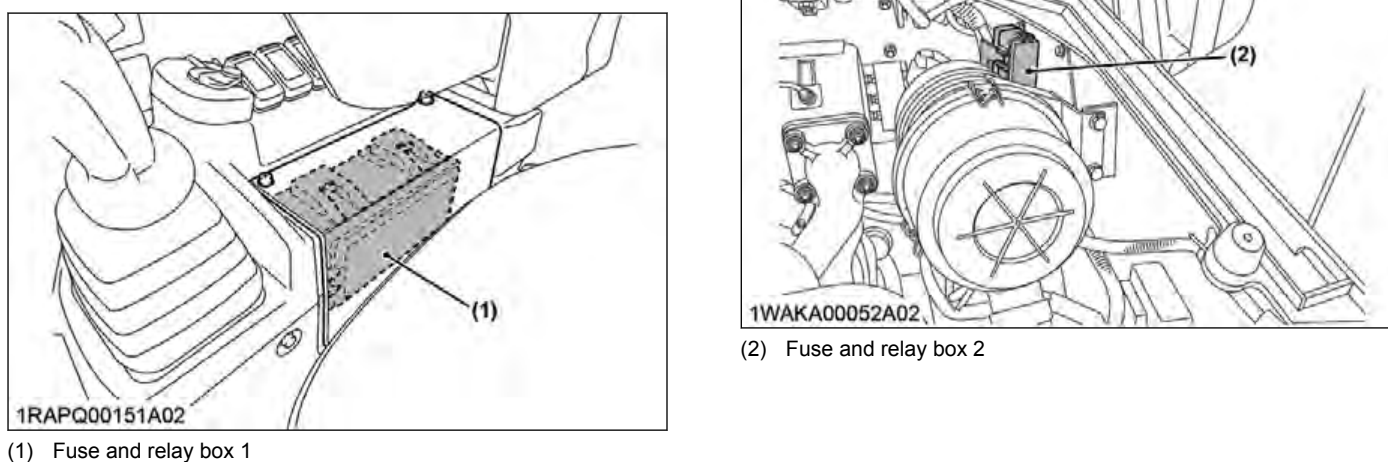
1.2 Switch layout



- | | | | |
|-----------------------------------|--|--|------------------------------|
| (1) Horn switch | (8) AUX hold switch LH | (12) Hydraulic quick hitch switch (hydraulic quick hitch specification only) | (15) Starter switch |
| (2) AUX electrical control switch | (9) AUX hold switch RH | (13) Wiper and washer switch (closed cab specification only) | (16) Hydraulic unlock switch |
| (3) Travel speed shift switch | (10) Float switch | (14) DPF regeneration inhibit switch | (17) Parking brake switch |
| (4) Blank | (11) AUX electrical mode change switch | | (18) AUX switch |
| (5) AUX electrical control switch | | | (19) Work light switch |
| (6) AUX electrical control switch | | | (20) Self-leveling switch |
| (7) AUX knob switch | | | |

1.3 Fuse and relay layout

Fuse and relay layout



Open cab specification

Electrical Outlet	AUX (H)		AUX (G)	
	SA Room Light (A) 20A Switch Front Lights SA 20A Rear Lights SA 20A Fuel Pump Control Elements SA Instrument Panel (HB) SA 20A Backup Power SA 20A ECU (HB) SA 20A Horn SA 20A ECU Engine Outlets	SA Indicator (A) 20A Switch (AC) SA 20A Rear Lights (AC) SA 20A Fuel (AC) SA 20A Horn SA 20A ECU Elements SA 20A ECU (HB) SA 20A Horn SA 20A ECU Engine Outlets	AUX (D)	AUX (C)
	AUX (F)	AUX (E)	AUX (J)	Front Work Lights
				Rear Work Lights

2CRRN00082A01enUS

10A ENGINE ELEMENTS	CCV HEATER	GLOW	STARTER	ENGINE
20A CCV HEATER				

2CRRN00084A01enUS

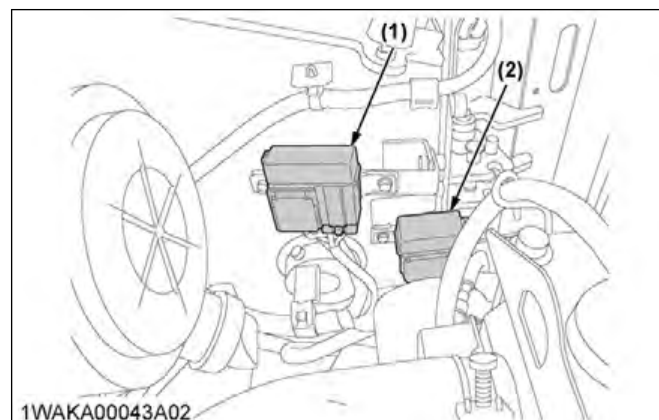
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2CRRN00083A01enUS

10A ENGINE ELEMENTS -----	CCV HEATER	GLOW	STARTER	ENGINE
20A CCV HEATER -----			COMPRESSOR CLUTCH	CONDENSER MOTOR

2CRRN00085A01enUS

Slow blow fuses layout



(1) Slow blow fuse 1

(2) Slow blow fuse 2

Open cab specification

30A	60A	30A	
ENGINE	MAIN	CCV HEATER	

2CRRN00087A01enUS

60A		100A
GLOW PLUGS		ALTERNATOR

2CRRN00088A01enUS

Closed cab specification

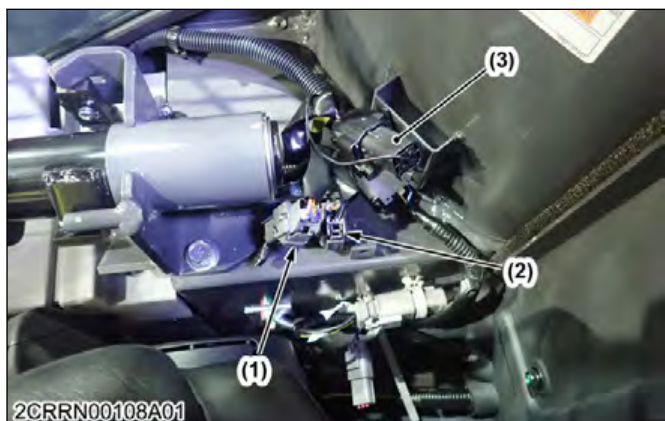
30A	60A	50A	20A
ENGINE	MAIN	CLOSED CAB	CONDENSER MOTOR

2CRRN00086A01enUS

60A		100A
GLOW PLUGS		ALTERNATOR

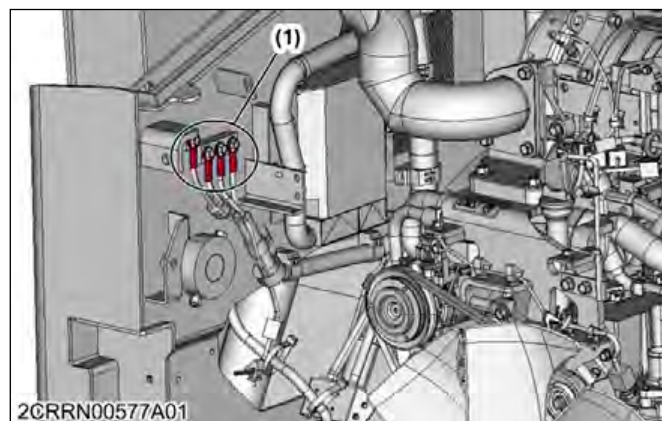
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1.5 Communication port layout

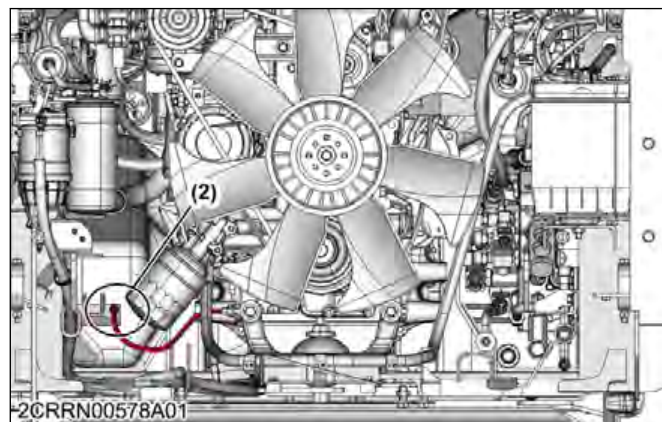


- (1) Setting connector (service dealer mode) (3) Service tool connector (Diag-master)
(2) CAN connector (K-OBD CE)

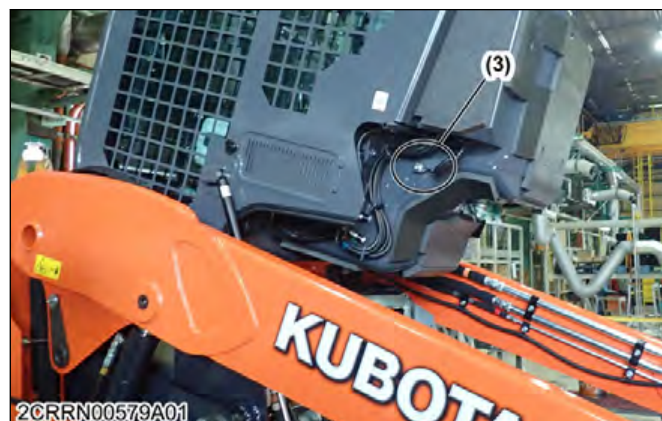
1.6 Ground wiring layout



(1) Ground wiring 1



(2) Ground wiring 2

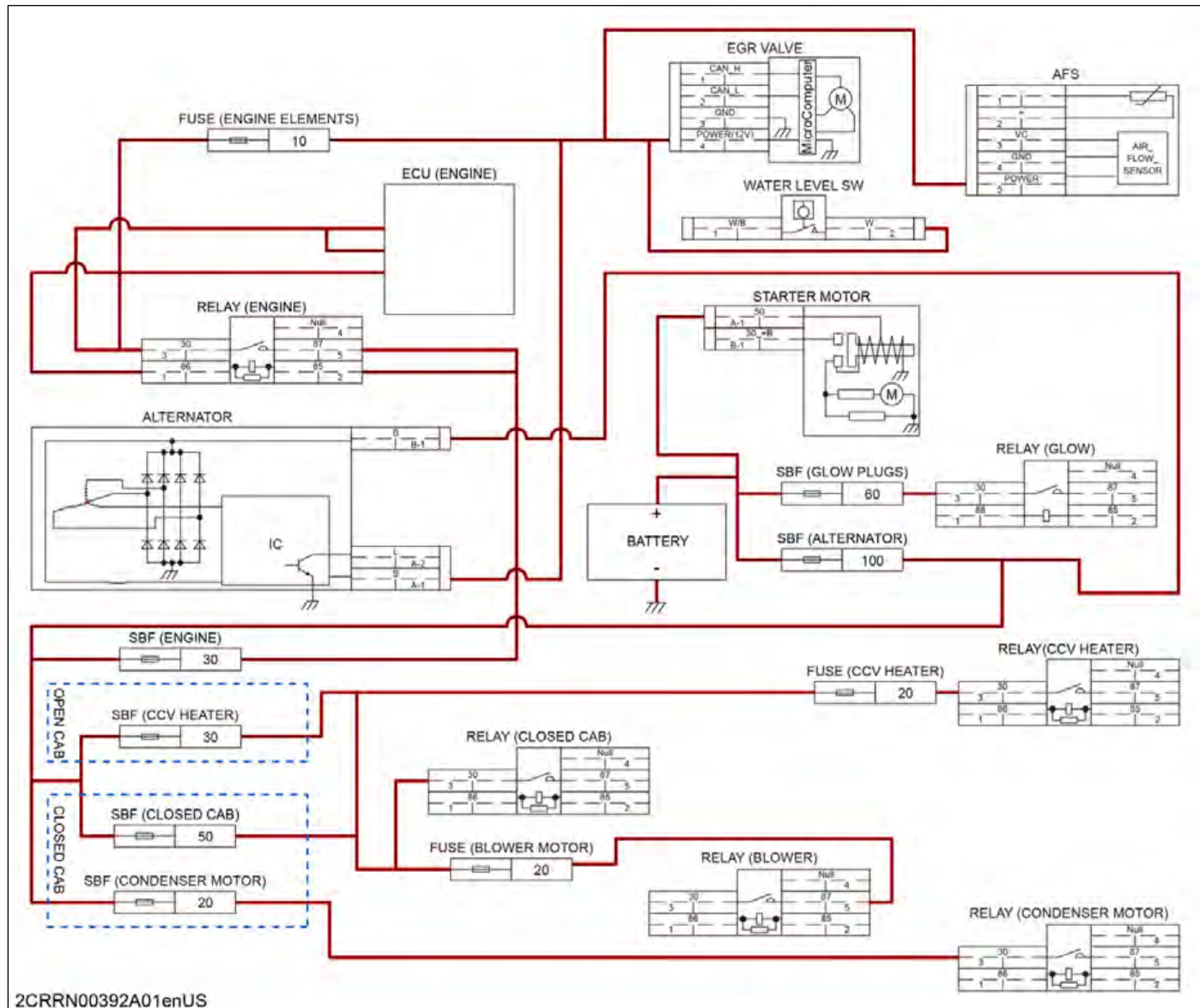


(3) Ground wiring 3

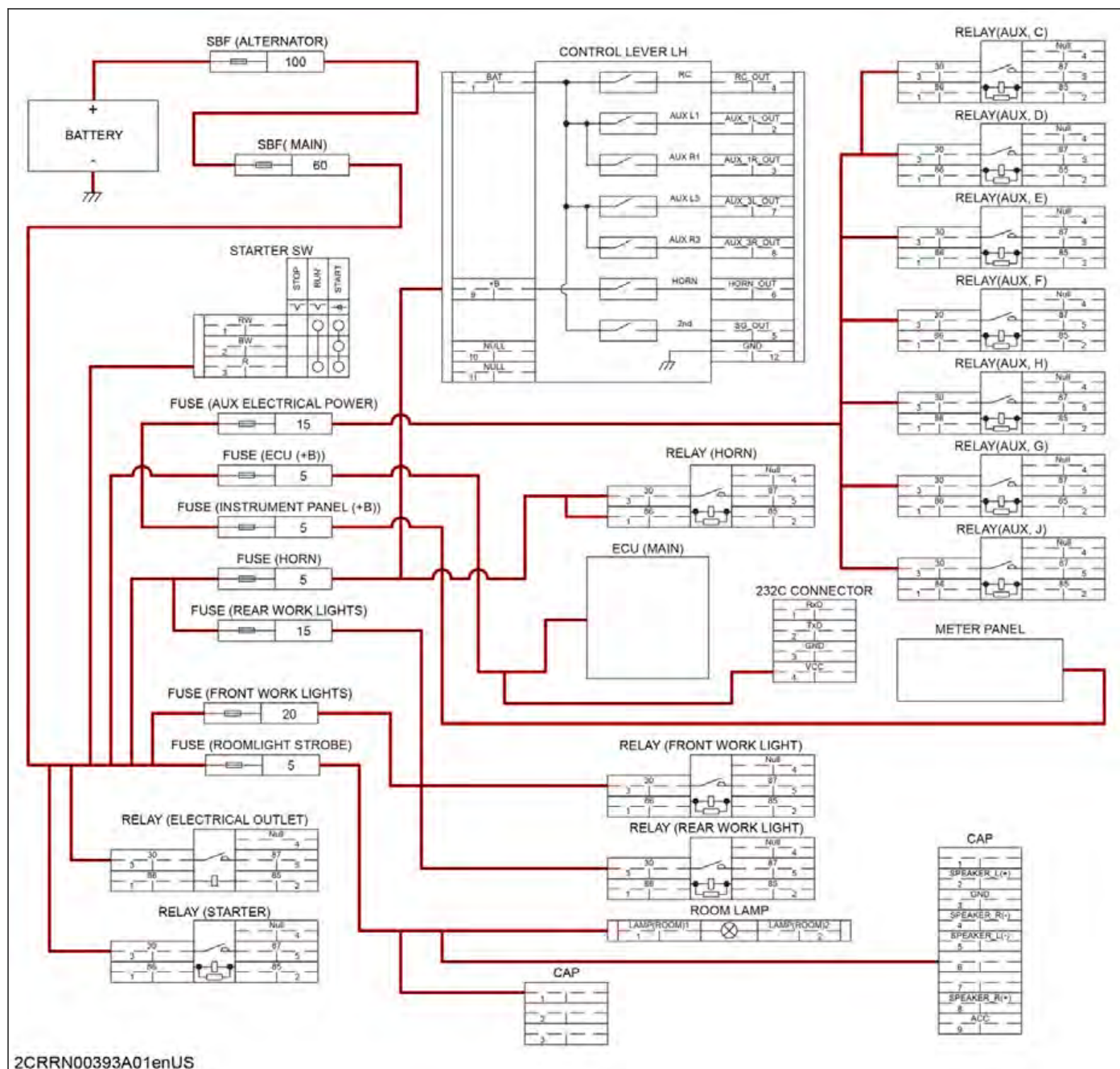
2. Functional electrical circuit

2.1 Power supply electrical circuit diagram

Power supply electrical circuit diagram 1



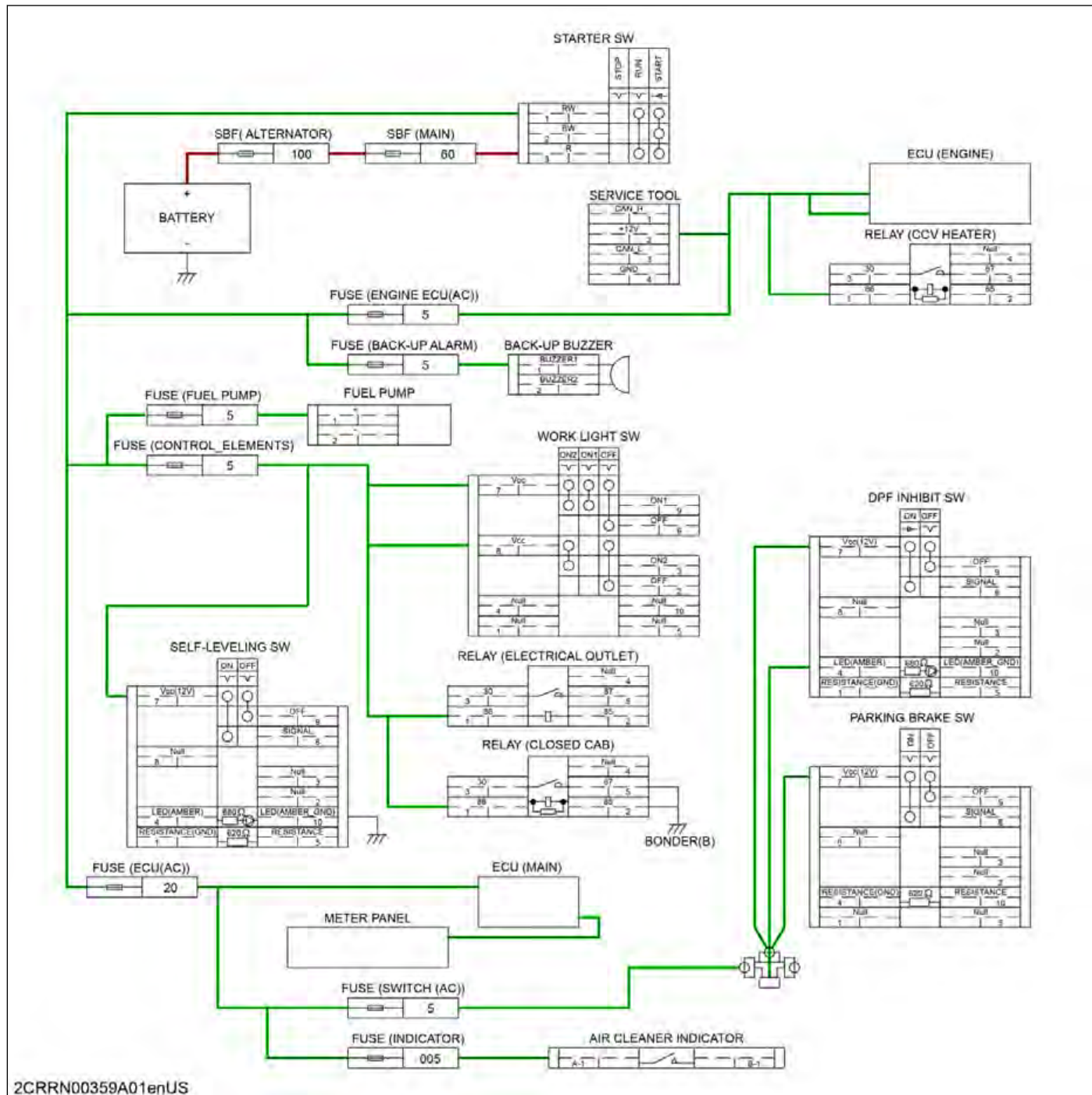
Power supply electrical circuit diagram 2



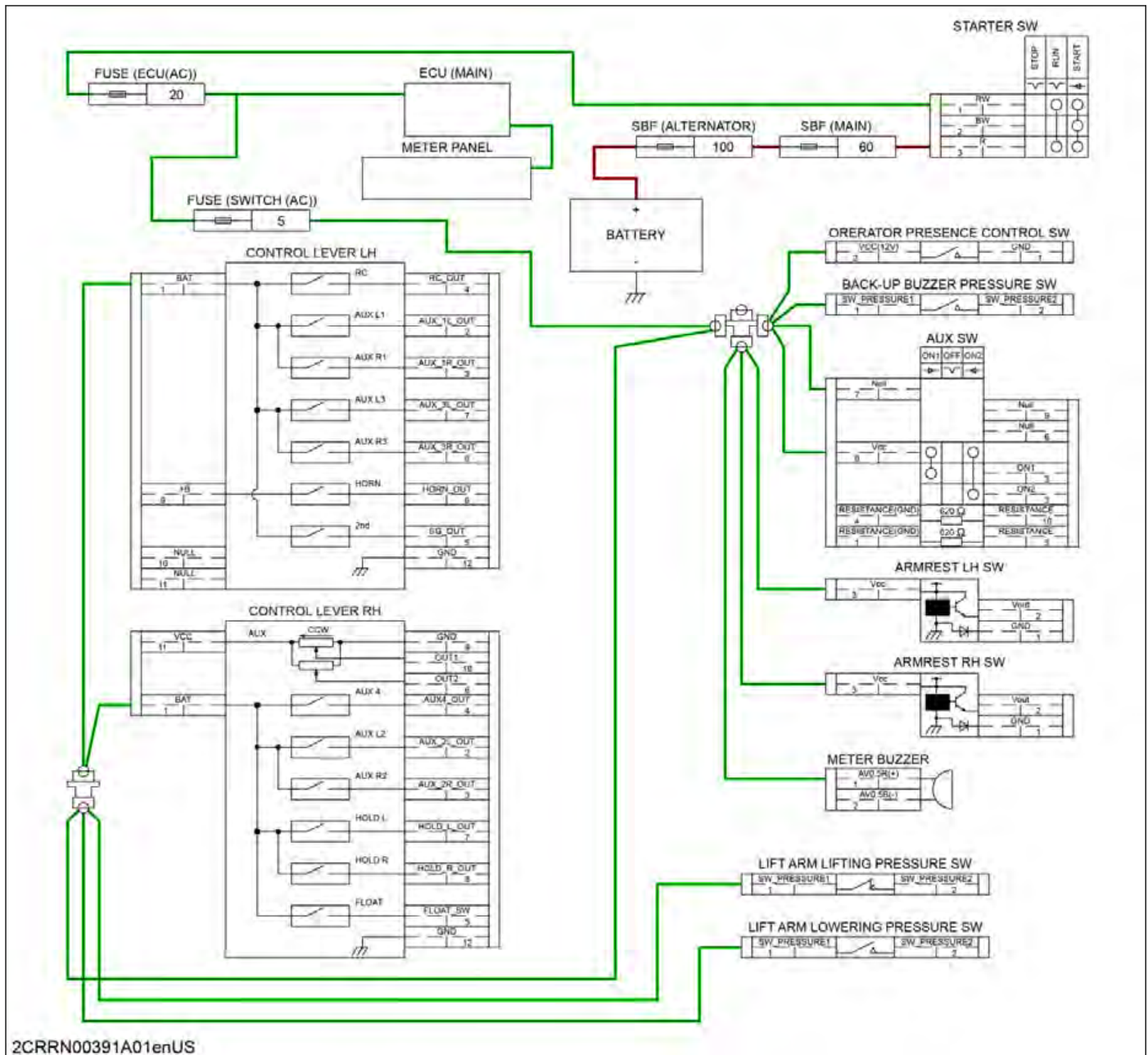
- In the case that the engine is stopped, the battery supplies approximately 12.0 V of electricity.
- In the case of running the engine, the alternator generates approximately 14.5 V of electricity.

2.2 Accessory electrical circuit diagram

Accessory electrical circuit diagram 1

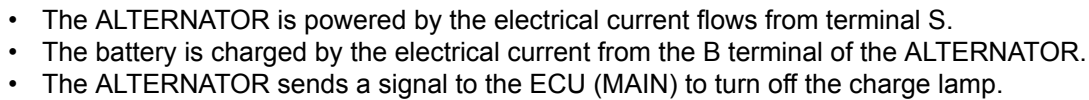


Accessory electrical circuit diagram 2

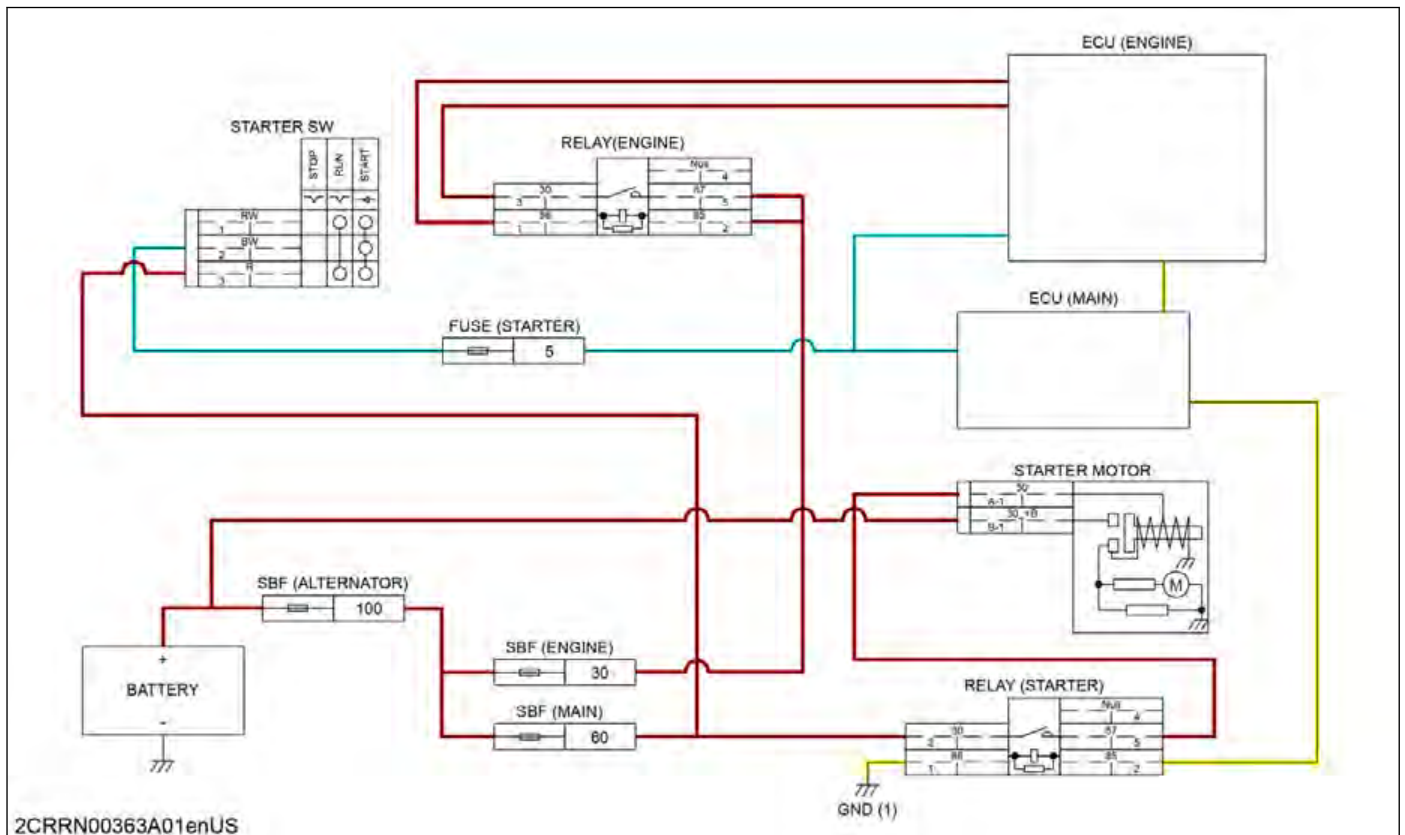


- When the STARTER SW is turned to **[RUN]**, the terminal #1 and #3 are connected inside of the STARTER SW.
- The electrical current from the STARTER SW flows to the each device through the fuses.
- The devices become active.

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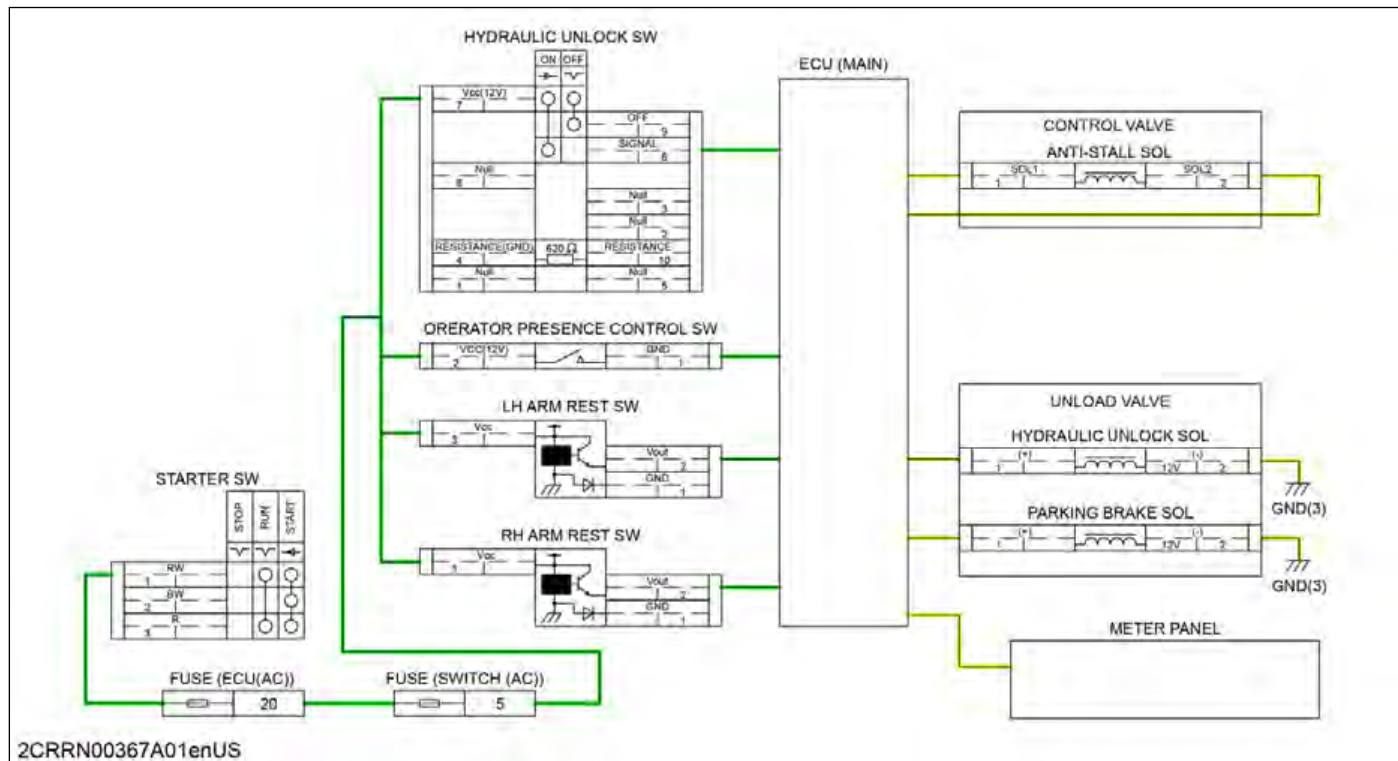


2.4 Engine start electrical circuit diagram



- When the STARTER SW is turned to **[RUN]**, the terminal #1 and #3 are connected inside of the STARTER SW.
- The electrical current from the STARTER SW flows to the ECU (MAIN) and ECU (ENGINE).
- The ECU (MAIN) sends a signal to the RELAY (STARTER).
- The RELAY (STARTER) is magnetized to flow the electrical current from the battery to the STARTER MOTOR.
- The STARTER MOTOR rotates to crank the engine.

2.5 Hydraulic unlock electrical circuit diagram



When the hydraulic system is locked

- The HYDRAULIC UNLOCK SW cuts off the electrical current to the ECU (MAIN).
- The ECU (MAIN) does not send a signal to the HYDRAULIC UNLOCK SOL.
- The hydraulic system is locked.

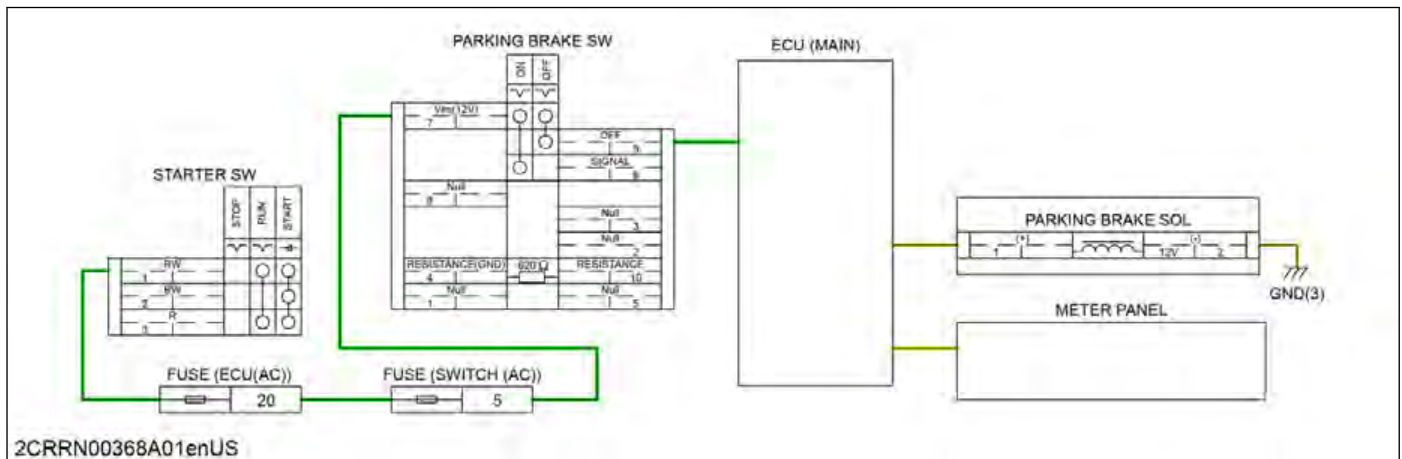
When the hydraulic system is unlocked

- The HYDRAULIC UNLOCK SW flows the electrical current to the ECU (MAIN).
- The ECU (MAIN) sends a signal to the HYDRAULIC UNLOCK SOL, PARKING BRAKE SOL, and ANTI-STALL SOL for the front attachment and traveling operation.
- The hydraulic system is unlocked, and the hydraulic lock lamp on the METER PANEL turns off.

NOTE

- To unlock the hydraulic system, the ECU (MAIN) needs to receive the following signals.
 - Signal from the OPERATOR PRESENCE CONTROL SW.
 - Signals from the RH ARM REST SW and LH ARM REST SW.

2.6 Parking brake electrical circuit diagram



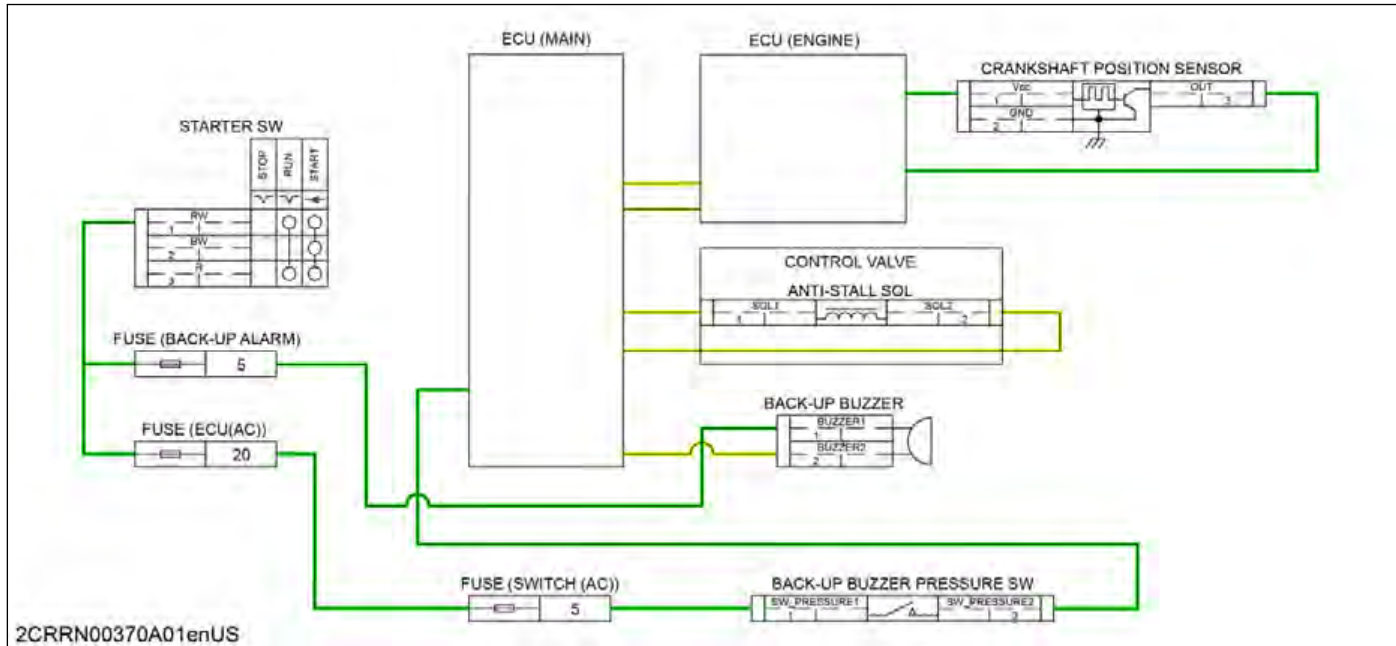
When the parking brake is engaged

- The PARKING BRAKE SW flows the electrical current from the STARTER SW to the ECU (MAIN).
- The ECU (MAIN) does not send a signal to the PARKING BRAKE SOL.
- The parking brake is engaged, and the parking brake lamp lights up on the METER PANEL.

When the parking brake is released

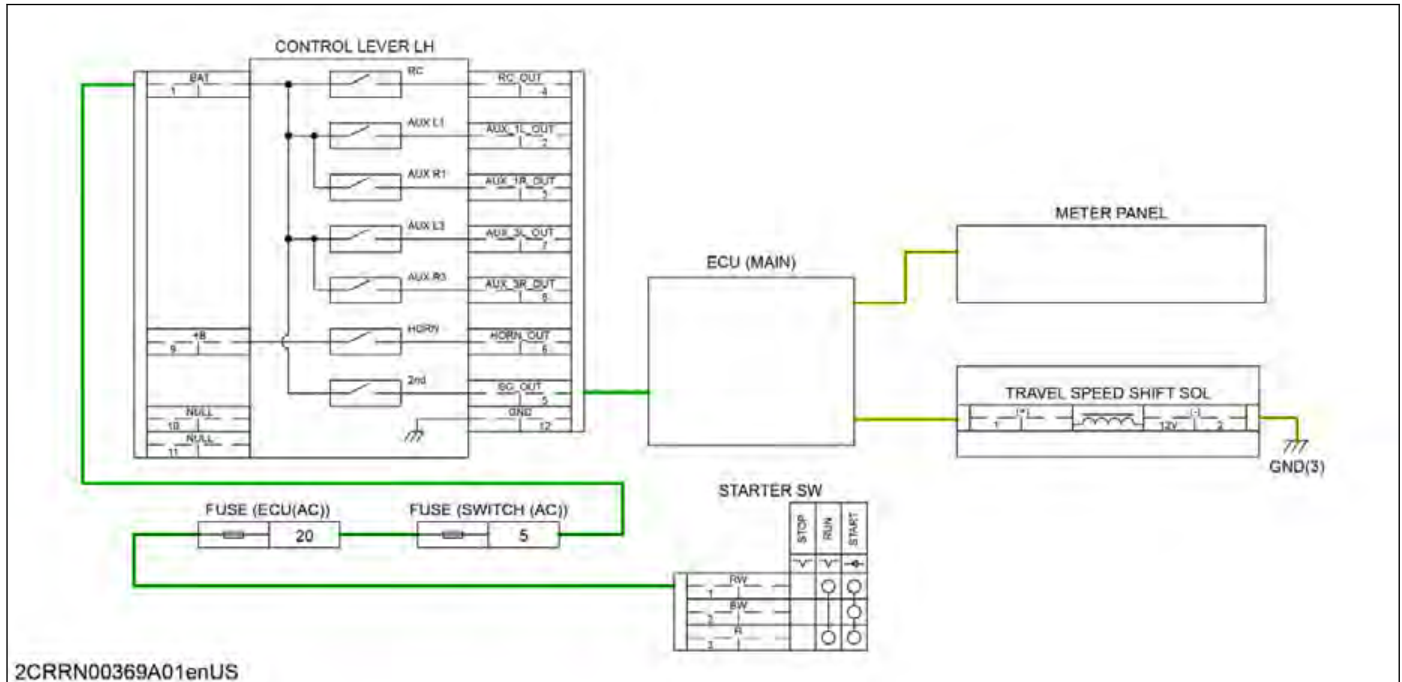
- The PARKING BRAKE SW cuts off the electrical current to the ECU (MAIN).
- The ECU (MAIN) sends a signal to the PARKING BRAKE SOL and METER PANEL.
- The parking brake is released, and the parking brake lamp on the METER PANEL turns off.

2.7 Traveling electrical circuit diagram



- The ECU (MAIN) sends a signal to the ANTI-STALL SOL to activate the travel pilot line.
- The ECU (ENGINE) detects the engine speed by the CRANKSHAFT POSITION SENSOR.
- The ECU (MAIN) communicates with the ECU (ENGINE) through the CAN line.
- The ECU (MAIN) detects the engine load based on the differential engine speed between the target and actual speed.
- According to the engine load, the ECU (MAIN) changes current applied on the ANTI-STALL SOL to control the horsepower consumption by the HST system optimally.
- When traveling backward, the BACK-UP BUZZER PRESSURE SW detects the pilot pressure for traveling backward.
- The ECU (MAIN) sends signal to the BACK-UP BUZZER to beep the buzzer.

2.8 Travel speed shift electrical circuit diagram



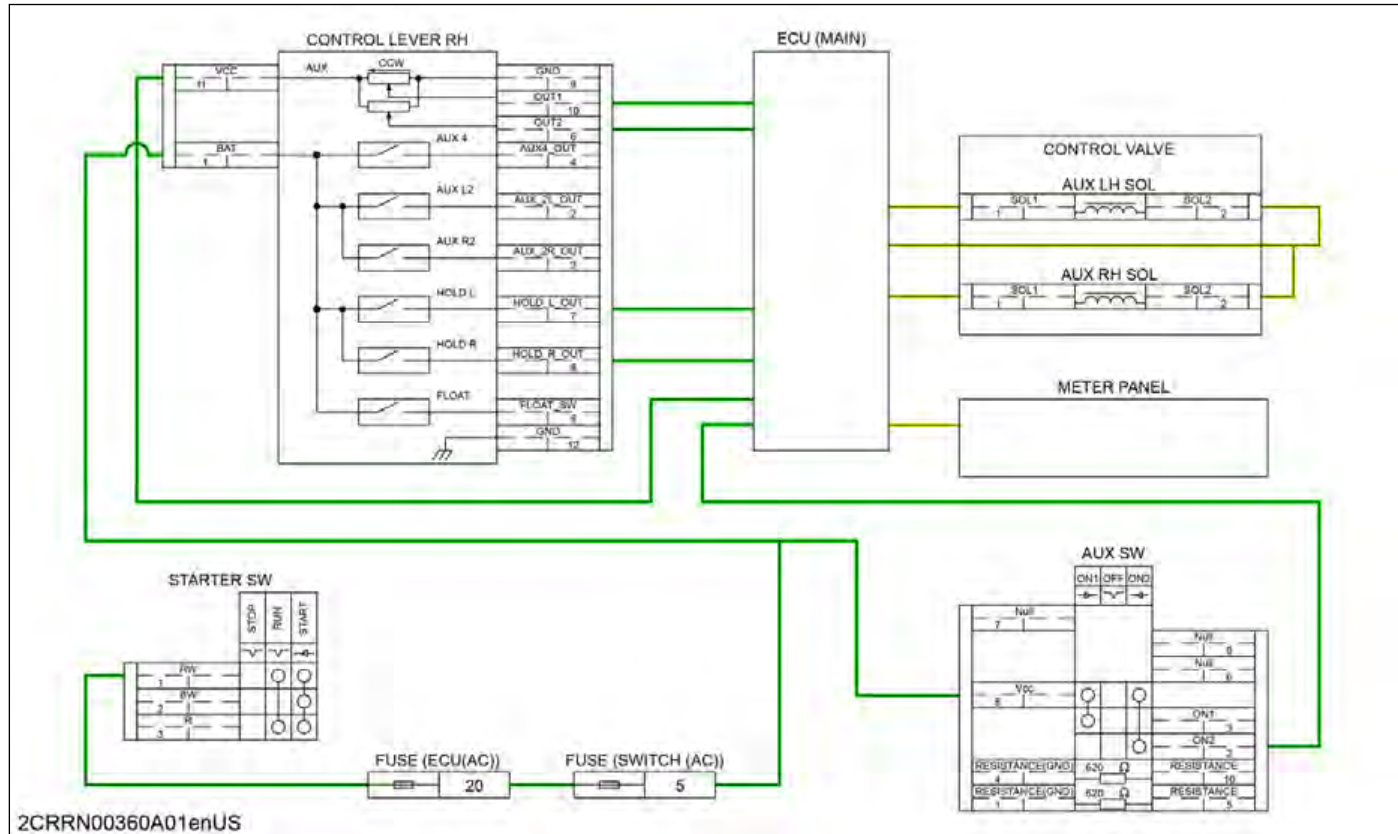
When traveling at low speed

- The CONTROL LEVER LH cuts off the electrical current to the ECU (MAIN).
- The ECU (MAIN) does not send a signal to the TRAVEL SPEED SHIFT SOL.
- The machine travels at low speed.

When traveling at high speed

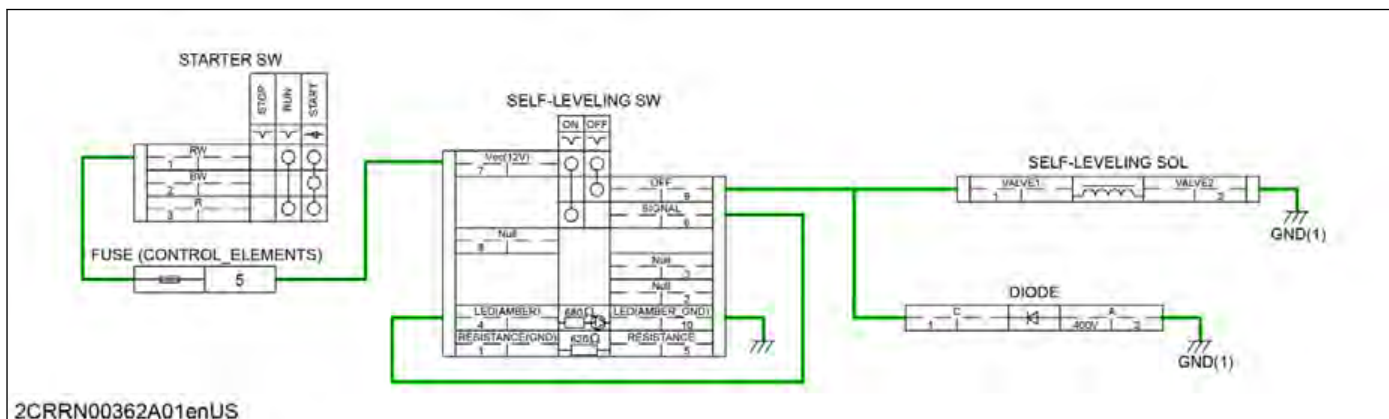
- The CONTROL LEVER LH flows the electrical current to the ECU (MAIN).
- The ECU (MAIN) sends a signal to the TRAVEL SPEED SHIFT SOL and METER PANEL.
- The TRAVEL SPEED SHIFT SOL is excited to change the pilot oil passage.
- The machine travels at high speed, and the high speed lamp lights up on the METER PANEL.

2.9 AUX operation electrical circuit diagram



- When the AUX SW is pressed, the AUX SW flows the electrical current to the ECU (MAIN).
- The ECU (MAIN) sends a signal to the METER PANEL to light up the AUX lamp.
- According to the AUX operation (knob switch or hold switch) on the CONTROL LEVER RH, the ECU (MAIN) changes the current flows to the AUX SOL to control the AUX pilot pressure proportionally.

2.10 Self-leveling electrical circuit diagram



When self-leveling is deactivated

- The SELF-LEVELING SW flows the electrical current from the STARTER SW to the SELF-LEVELING SOL and DIODE.
- The SELF-LEVELING SOL is excited, and the self-leveling function is deactivated.

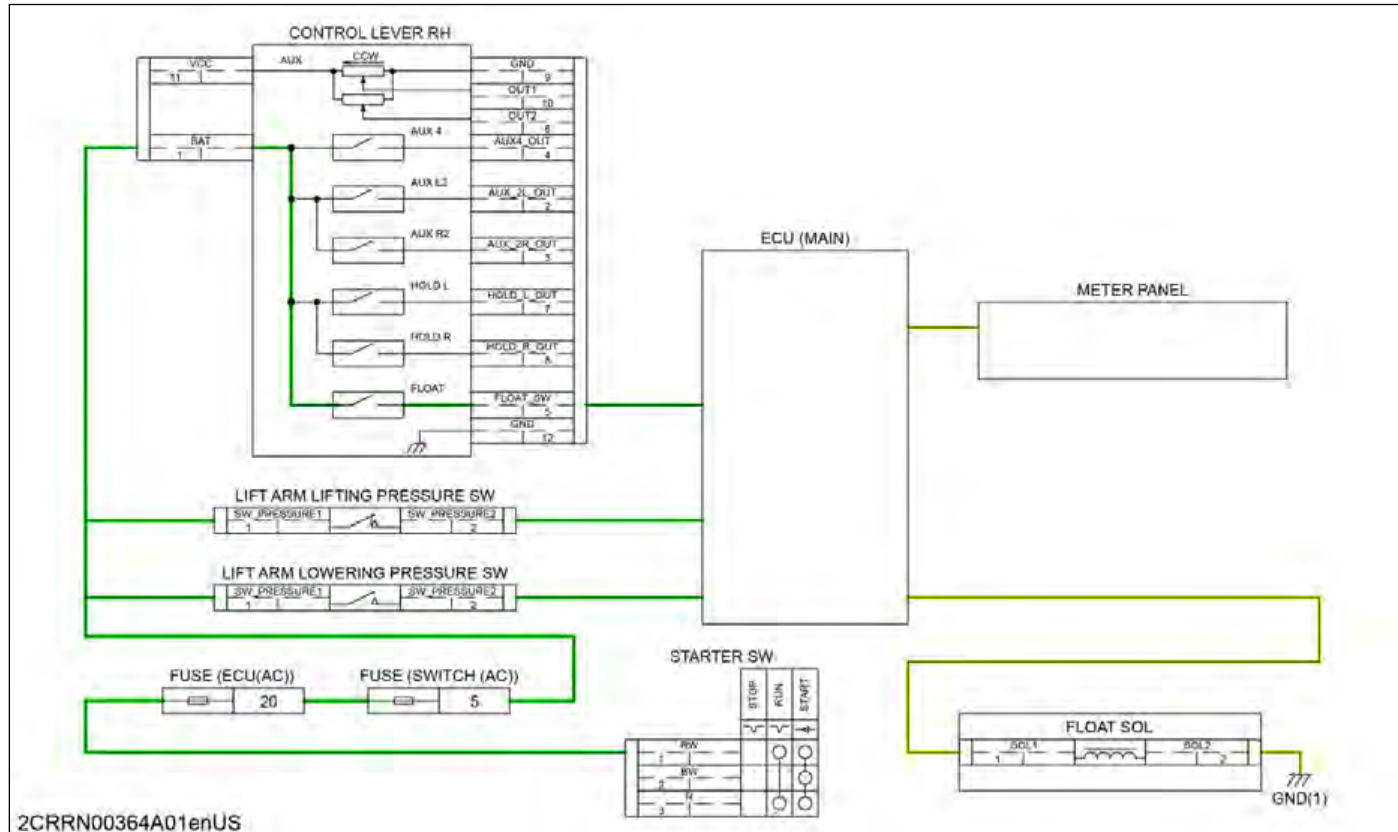
When self-leveling is activated

- The SELF-LEVELING SW flows the electrical current from the STARTER SW to the LED.
- The LED on the SELF-LEVELING SW is lit.
- The SELF-LEVELING SOL is not excited, and the self-leveling function is activated.

NOTE

- Since the main ECU is not involved in this self-leveling electrical circuit, any error code is not displayed in case of short circuit or broken harness in this circuit.

2.11 Float electrical circuit diagram



When float is deactivated

- The CONTROL LEVER RH cuts off the electrical current to the ECU (MAIN).
- The ECU (MAIN) does not send a signal to the FLOAT SOL.
- Float is deactivated.

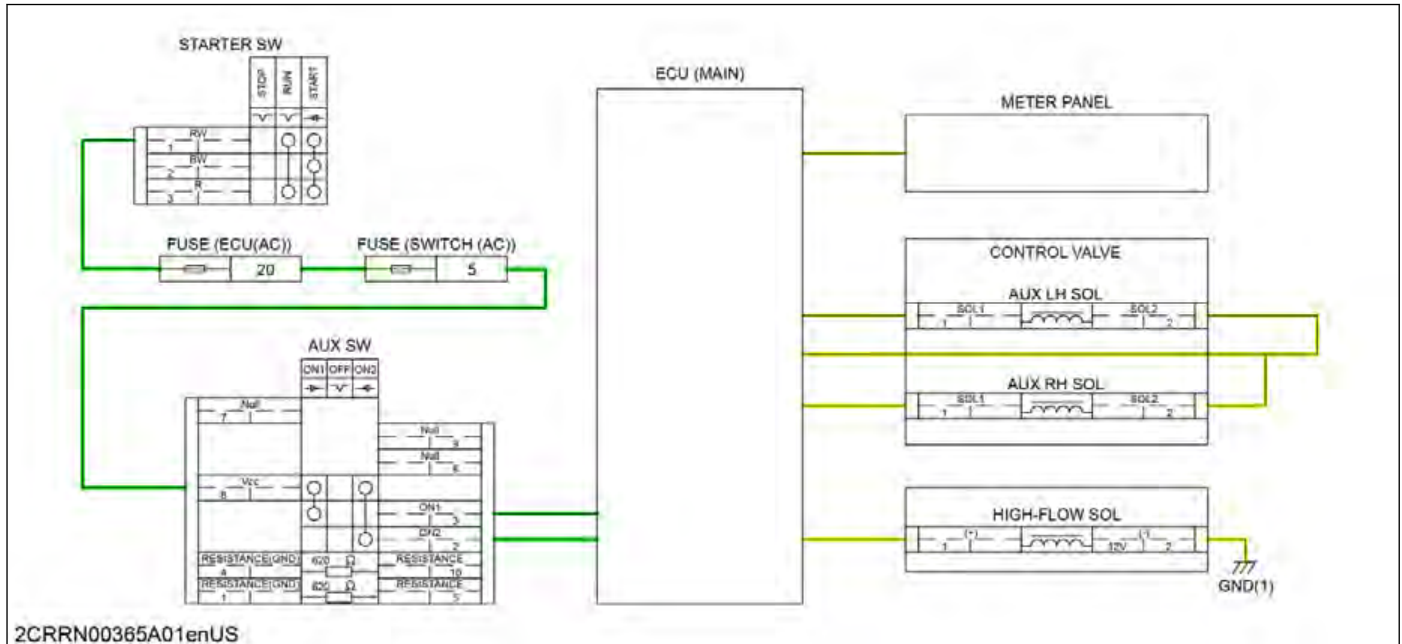
When float is activated

- When the float switch is pressed, the CONTROL LEVER RH flows the electrical current to the ECU (MAIN).
- The ECU (MAIN) sends a signal to the METER PANEL and FLOAT SOL.
- Float is activated and the float lamp lights up on the METER PANEL.

NOTE

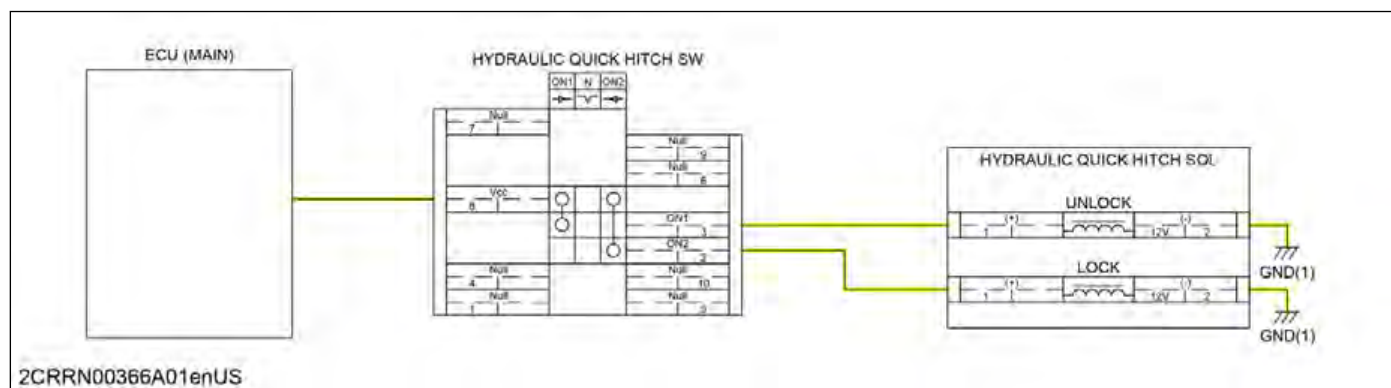
- Float can be activated when the float switch is pressed with the following conditions.
 - The LIFT ARM LIFTING PRESSURE SW sends a signal to the ECU (MAIN).
 - The LIFT ARM LOWERING PRESSURE SW sends a signal to the ECU (MAIN).

2.12 High-flow electrical circuit diagram



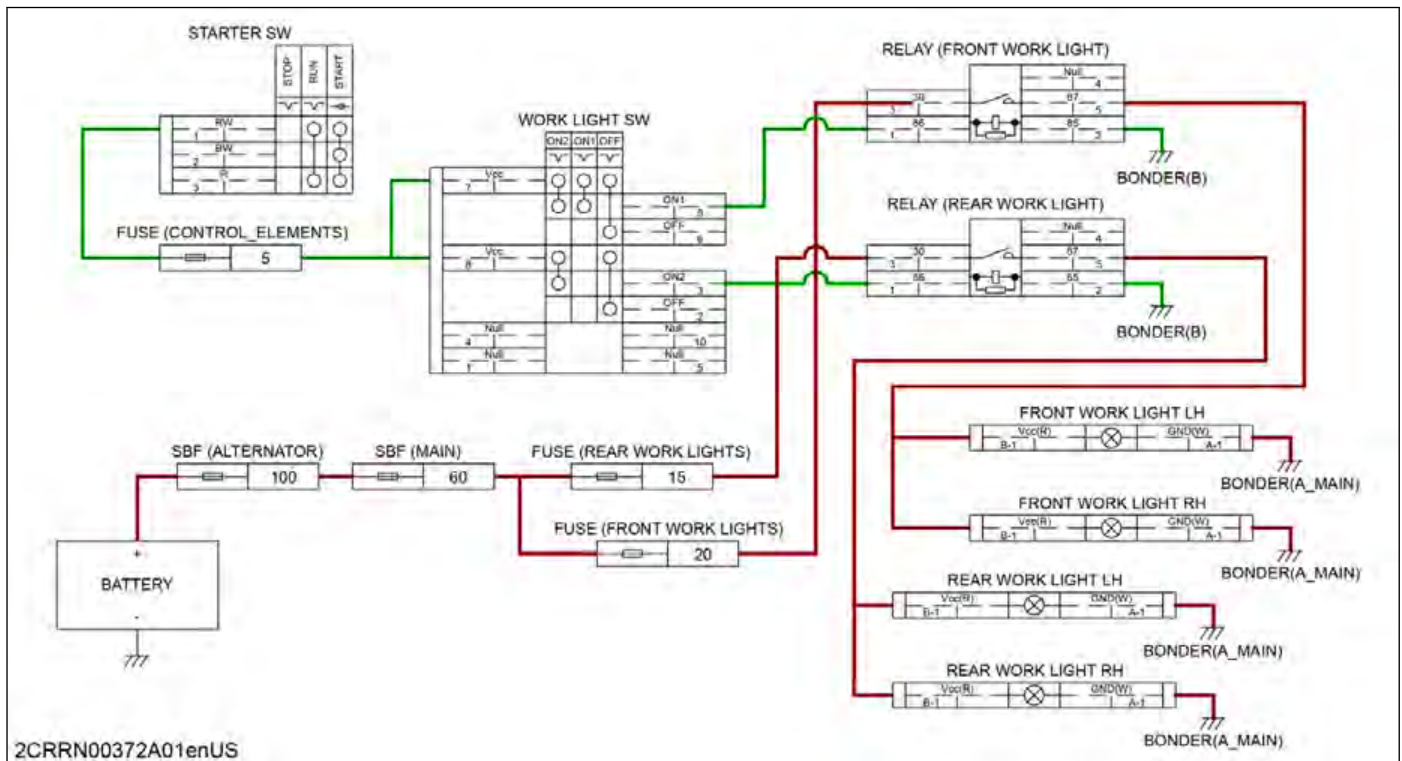
- Pressing and holding the AUX SW flows the electrical current to the ECU (MAIN).
- The ECU (MAIN) sends a signal to the HIGH-FLOW SOL and METER PANEL.
- High-flow is activated and the AUX lamp on the METER PANEL blinks.

2.13 Hydraulic quick hitch electrical circuit diagram



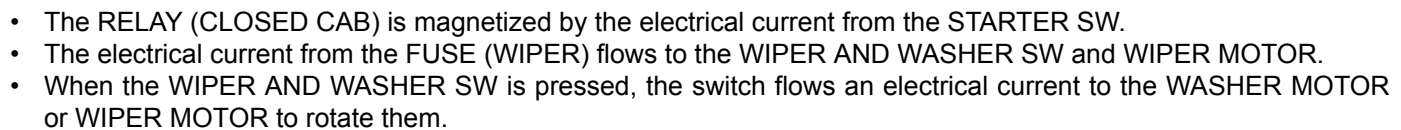
- The ECU (MAIN) supplies an electrical current to the HYDRAULIC QUICK HITCH SW.
- According to the HYDRAULIC QUICK HITCH SW operation, the switch flows the electrical current to the HYDRAULIC QUICK HITCH SOL.

2.14 Work light electrical circuit diagram



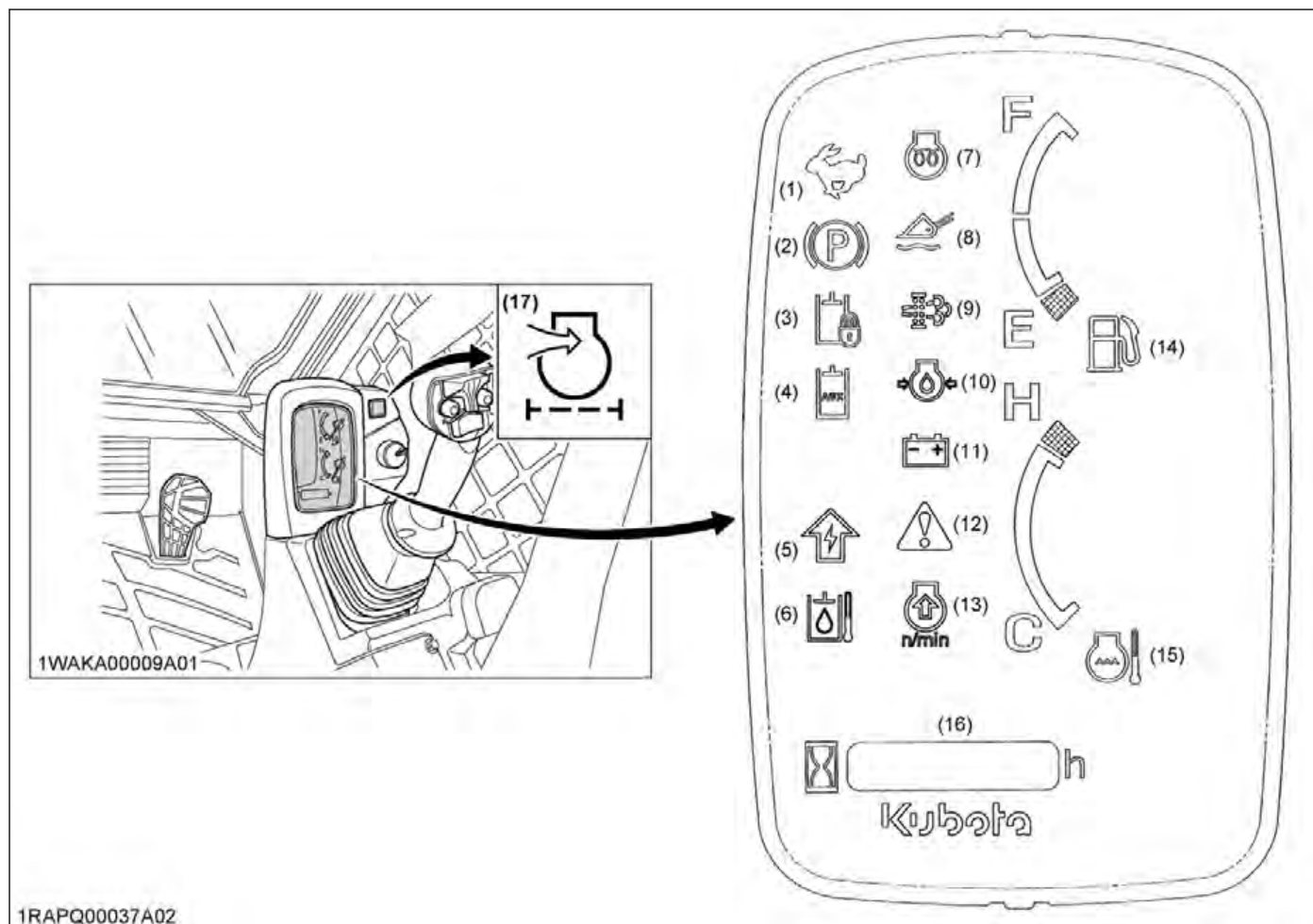
- The WORK LIGHT SW is powered by the electrical current from the STARTER SW.
- When the WORK LIGHT SW is pressed, the WORK LIGHT SW flows the electrical current to the RELAY (FRONT WORK LIGHT) and RELAY (REAR WORK LIGHT).
- The relays are magnetized.
- The current from the relays flows to the work lights to turn on the lights.

2CRRN00371A01enUS



3. Meter panel

3.1 Meter panel function



No.	Name	Function
(1)	Travel speed shift lamp	Lit - high speed
(2)	Parking brake lamp	Lit - parking brake is activated
(3)	Hydraulic lock lamp	Lit - hydraulic system is locked
(4)	AUX lamp	Lit - AUX is activated Blinking - high-flow is activated
(5)	AUX electrical mode change lamp	Lit - AUX electrical mode change is activated
(6)	Hydraulic oil temperature warning lamp	Blinking - hydraulic oil temperature is high
(7)	Glow lamp	Lit - warming up the engine
(8)	Float lamp	Lit - float is activated
(9)	DPF regeneration lamp	Lit - regenerating the DPF
(10)	Engine oil pressure warning lamp	Lit - engine oil pressure switch is ON, engine oil pressure is low
(11)	Battery charging warning lamp	Lit - battery voltage is low
(12)	Warning lamp	Blinking - error occurred

(Continued)

No.	Name	Function
(13)	Engine rev up lamp	Blinking - needs to rev up the engine for DPF regeneration
(14)	Fuel gauge lamp	Blinking - fuel level is low
(15)	Water temperature warning lamp	Blinking - water temperature is high
(16)	LCD	—
(17)	Air cleaner warning lamp	Lit - air cleaner element is clogged

3.2 Display mode

Mode	Function	Operation
Normal mode	Hour meter	Turn the starter switch to [RUN] .
	Error code	Displayed when an error has occurred.
Service dealer mode	Tester mode	Turn the starter switch to [RUN] while the setting connector is disconnected. Connect the connector again within 10 seconds after turning the starter switch to [RUN] .
	AUX knob switch setting	
	AUX start-up point setting	
	AUX fine adjustment	
	HST start-up point setting	
	Accelerator pedal and dial setting	
	Reading error history	
	Clearing error history	
	Reading all error history	

3.3 Service dealer mode

3.3.1 Service dealer mode list

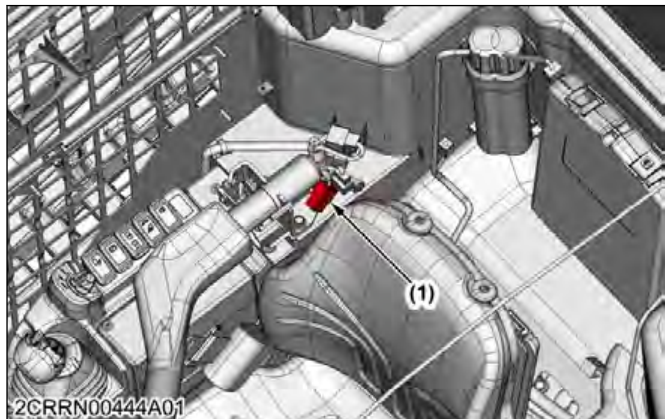
The service dealer mode is used for maintenance such as checking the machine condition, setting parameters, and adjusting the devices. To enter the service dealer mode, turn the starter switch to **[RUN]** while the setting connector is disconnected, and then connect the setting connector.

■ IMPORTANT

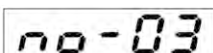
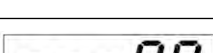
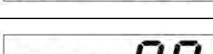
- After replacing the main ECU, set all of the following items.

■ NOTE

- To exit the service dealer mode, turn the starter switch to **[STOP]**.
- The setting connector is located under the cover next to the armrest RH.



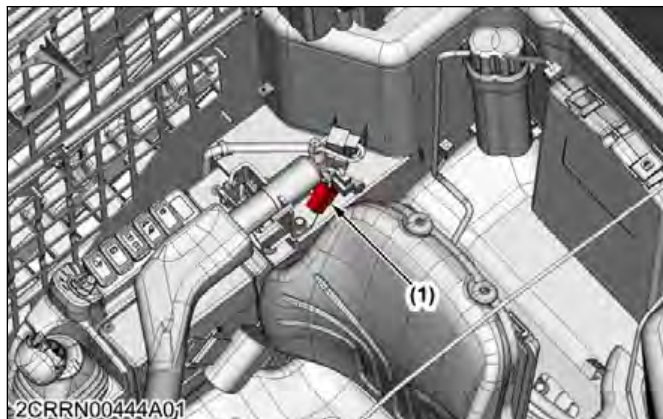
(1) Setting connector

Mode		Detail
	Tester mode	Displays the machine information, and status of sensors and solenoids.
	AUX knob switch setting	Sets the left and right ends and neutral position for the AUX knob switch. • Required setting after replacing the AUX knob switch.
	AUX start-up point setting	Sets the start-up point of the AUX with attachment. • Required setting after replacing an attachment or cylinder. • Required setting after repairing hydraulic devices.
	AUX fine setting	Fine setting for the start-up point of the actuator (cylinder) attached to the AUX.
	HST start-up point settings	Sets the start-up point of the forward and backward travel. • Required setting after replacing the HST pump, travel control valve, or anti-stall proportional solenoid.
	Accelerator pedal and dial setting	Sets the maximum and minimum position for the accelerator pedal and dial. • Required setting after replacing the accelerator pedal, accelerator dial, or potentiometer.
	Model setting	Sets the model, AUX flow (normal flow or high-flow) and accelerator specification (accelerator dial or accelerator lever).
	Reading error history	Displays the previous error code and hour meter from the main ECU.
	Clearing error history	Clears error history of “no-09”.
	Reading all error history	Displays the previous error code and hour meter from the main ECU. • Unable to clear in “no-10” (clearing error history).

3.3.2 Operating service dealer mode

Operating service dealer mode

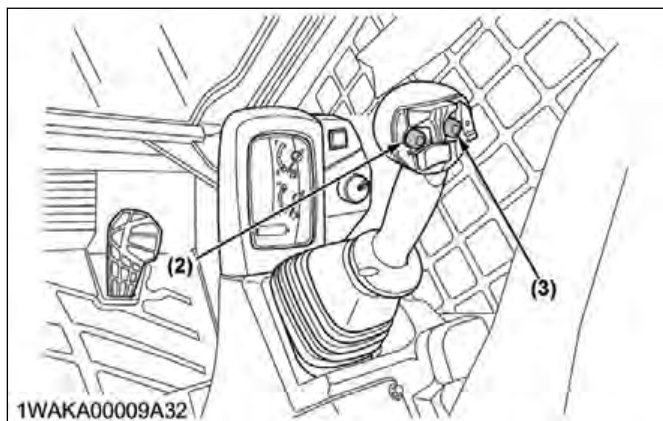
1. Disconnect the setting connector.



(1) Setting connector

2. Turn the starter switch to **[RUN]** and connect the setting connector within 10 seconds.
3. Displays “no-1”.
4. Press the AUX hold switch RH to select a mode.
5. Press and hold the AUX hold RH switch to enter the mode.
6. Press and hold the AUX hold switch LH to exit the mode.
7. Turn the starter switch to **[STOP]** to exit the service dealer mode.

Switches



(2) AUX hold switch LH

(3) AUX hold switch RH

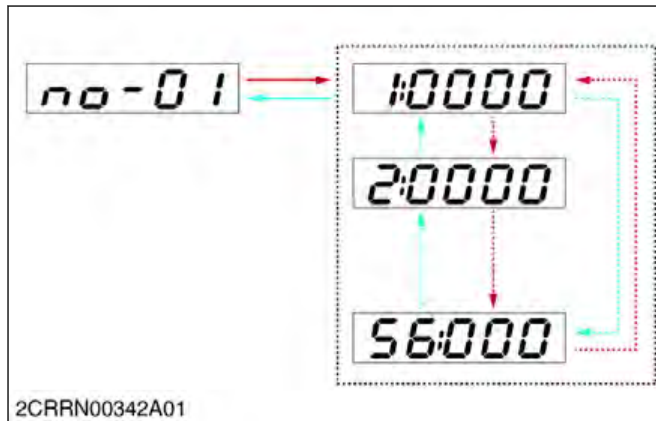
Switch	Operation	Symbol	Function
AUX hold switch LH	Press		Decrease a number
	Press and hold		Exit a mode
AUX hold switch RH	Press		Increase a number
	Press and hold		Enter a mode

3.3.3 Operating no-01 (Tester mode)

Displays the machine information, and status of sensors and solenoids.

Operating “no-01” (Tester mode)

1. Press the AUX hold switch RH or LH to select “no-01” in the service dealer mode.
2. Press and hold the AUX hold switch RH to enter “no-01”.
3. Press the AUX hold switch RH or AUX hold switch LH to select a number of the tester (from “1” to “56”).
4. Press and hold the AUX hold switch LH to exit the tester mode.



Tester mode list

No.		Display	Description
1	Engine speed	“oooo” rpm	• Present engine speed
2	Battery voltage	“oo.o” V	• Engine stopped: approximately 12.0 V • Engine running: approximately 14.0 V
3	Engine oil pressure switch	“ON” or “OFF”	• Engine stopped: “ON” • Engine running: “OFF”
4	Battery charge switch	“ON” or “OFF”	• Engine stopped: “ON” • Engine running: “OFF”
5	Starter switch	“ON” or “OFF”	• Starter switch [START]: “ON” • Starter switch [RUN] or [STOP]: “OFF”
6	Work light switch	“ON” or “OFF”	• Switch pressed: “ON” • Switch released: “OFF”
7	Coolant temperature	“ooo.o” °C	• More than 120 °C (248 °F): engine overheating warning
8	Hydraulic oil temperature	“ooo.o” °C	• More than 103 °C (217 °F): hydraulic oil overheating warning • Less than -50 °C (-58 °F), more than 150 °C (302 °F): hydraulic oil temperature sensor error
9	Accelerator pedal output voltage (main)	“o.oo” V	• Present main output voltage
10	Accelerator pedal output voltage (sub)	“o.oo” V	• Present sub output voltage
11	Accelerator dial output voltage (main)	“o.oo” V	• Present main output voltage
12	Accelerator dial output voltage (sub)	“o.oo” V	• Present sub output voltage
13	Accelerator pedal minimum output voltage (main)	“o.oo” V	• Value which is adjusted in the service dealer mode (“no-07”: accelerator pedal and dial setting)
14	Accelerator pedal maximum output voltage (main)	“o.oo” V	• Value which is adjusted in the service dealer mode (“no-07”: accelerator pedal and dial setting)

(Continued)

No.		Display	Description
15	Accelerator dial minimum output voltage (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-07": accelerator pedal and dial setting)
16	Accelerator dial maximum output voltage (main)	"ON" or "OFF"	Value which is adjusted in the service dealer mode ("no-07": accelerator pedal and dial setting)
17	Fuel level sensor (voltage)	"0.00" V	Present voltage of the fuel level sensor.
18	Fuel level sensor (resistance)	"000" Ω	More than 135 Ω: fuel level sensor error
19	Water separator full water switch	"ON" or "OFF"	- Water separator is full with water: "ON" - Water separator is not full with water: "OFF"
20	Travel speed shift switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
21	Travel speed shift solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
22	Hydraulic unlock switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
23	Hydraulic unlock solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
24	AUX switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
25	AUX relay	"ON" or "OFF"	- AUX is activated: "ON" - AUX is deactivated: "OFF"
26	High-flow switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
27	High-flow solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
28	Armrest switch RH	"ON" or "OFF"	- Armrest RH is lowered: "ON" - Armrest RH is raised: "OFF"
29	Armrest switch LH	"ON" or "OFF"	- Armrest LH is lowered: "ON" - Armrest LH is raised: "OFF"
30	Parking brake switch	"ON" or "OFF"	- Switch pressed: "OFF" - Switch released: "ON"
31	Parking brake solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
32	Float switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
33	Float solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
34	Lift arm pressure switch (raising)	"ON" or "OFF"	- Lift arm raising pilot pressure is not detected: "ON" - Lift arm raising pilot pressure is detected: "OFF"
35	Lift arm pressure switch (lowering)	"ON" or "OFF"	- Lift arm lowering pilot pressure is detected: "ON" - Lift arm lowering pilot pressure is not detected: "OFF"
36	Setting connector	"ON" or "OFF"	- The setting connector is connected: "ON" - The setting connector is disconnected: "OFF"

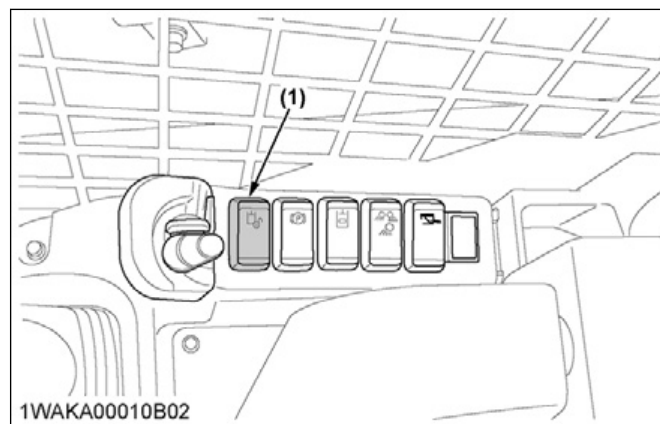
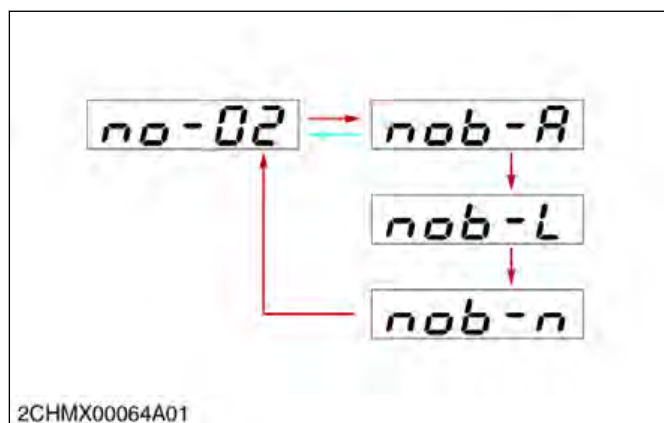
(Continued)

No.		Display	Description
37	Back-up buzzer pressure switch	"ON" or "OFF"	- Travel backward pilot pressure is detected: "ON" - Travel backward pilot pressure is not detected: "OFF"
38	Back-up buzzer output	"ON" or "OFF"	- ECU is sending signal to the back-up buzzer: "ON" - ECU is not sending signal to the back-up buzzer: "OFF"
39	OPC (operator presence control) switch	"ON" or "OFF"	- Operator is on the operator's seat: "ON" - Operator is not on the operator's seat: "OFF"
40	DPF regeneration inhibit switch lamp	"ON" or "OFF"	- The inhibit lamp is lit: "ON" - The inhibit lamp is not lit: "OFF"
41	DPF regeneration inhibit switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
42	DPF manual regeneration switch	"ON" or "OFF"	- DPF is regenerated manually: "ON" - DPF is not regenerated manually: "OFF"
43	AUX knob switch output voltage (main)	"0.00" V	Present main output voltage
44	AUX knob switch sub output voltage (sub)	"0.00" V	Present sub output voltage
45	AUX knob switch output voltage at LH end (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-02": AUX knob switch setting)
46	AUX knob switch output voltage at neutral position (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-02": AUX knob switch setting)
47	AUX knob switch output voltage at RH end (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-02": AUX knob switch setting)
48	AUX current	"0.0" A	Current applied on the AUX proportional valve
49	AUX LH current start-up setting value	"0.0" A	Value which is adjusted in the service dealer mode ("no-03": AUX start-up point setting)
50	AUX RH current start-up setting value	"0.0" A	Value which is adjusted in the service dealer mode ("no-03": AUX start-up point setting)
51	Hydraulic quick hitch solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
52	Anti-stall current	"0.0" A	Current applied on the anti-stall proportional valve
53	Cab relay	"ON" or "OFF"	- Engine is running: "ON" - Engine is not running: "OFF"
54	Buzzer	"ON" or "OFF"	- Buzzer is beeping from the meter panel: "ON" - Buzzer is not beeping from the meter panel: "OFF"
55	Model setting	"3" "6"	The number represents the model setting in the service dealer mode. - SVL75-2: 3 - SVL65-2: 6
56	AUX flow	"ON" or "OFF"	- High-flow is selected in the model setting: "ON" - Normal flow is selected in the model setting: "OFF"

3.3.4 Operating no-02 (AUX knob switch setting)

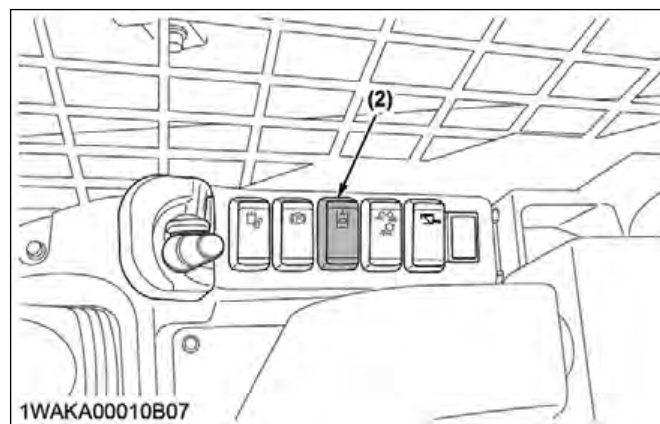
Set the RH end, LH end, and neutral position of the AUX knob switch.

1. Press the AUX hold switch RH or LH to select "no-02" in the service dealer mode.
2. Press and hold the AUX hold switch RH to enter "no-02".
3. When "nob-R" is displayed, slide and hold the AUX knob switch to the RH end, and press and hold the AUX hold switch RH.
4. When "nob-L" is displayed, slide and hold the AUX knob switch to the LH end, and press and hold the AUX hold switch RH.
5. When "nob-n" is displayed, release the AUX knob switch so that it stays in neutral position, and press and hold the AUX hold switch RH.
6. A buzzer beeps, and it returns to "no-02".



(1) Hydraulic unlock switch

5. Press the AUX switch to activate the AUX.



(2) AUX switch

3.3.5 Operating no-03 (AUX start-up point setting)

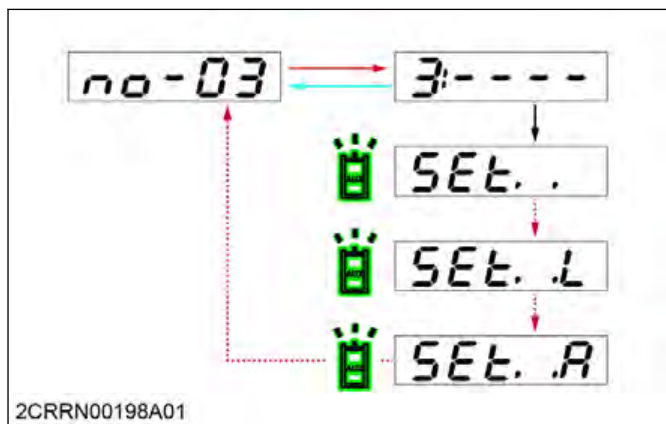
Adjusts the start-up point for AUX with an attachment mounted.

CAUTION

- In this setting, the attachment automatically starts moving. Make sure that the area around the machine is free of any persons or obstructions.

1. Press the AUX hold switch RH or LH to select "no-03" in the service dealer mode.
2. Press and hold the AUX hold switch RH to enter "no-03".
3. "3:--" is displayed.
4. Start the engine and press the hydraulic unlock switch.

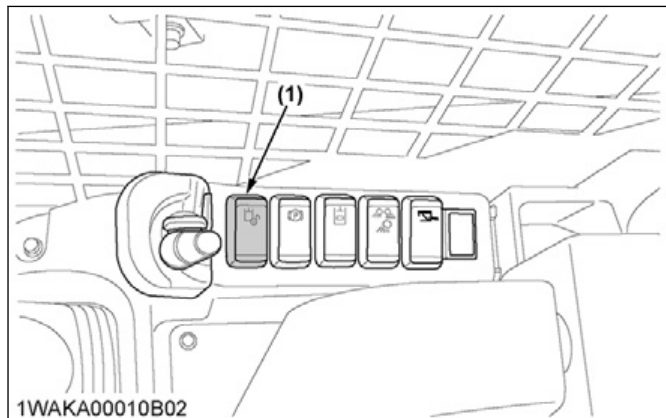
6. When "set.." is displayed and AUX lamp lights up, increase the engine speed to the maximum.
7. Slide the AUX knob switch to move the attachment to the middle position of its cylinder.
8. Press the AUX hold switch RH.
9. "set-L" is displayed, and the attachment automatically starts moving with a beep sound.
10. Press the AUX hold switch RH when the attachment starts moving.
11. "set-R" is displayed, and the attachment automatically starts moving to opposite direction with a beep sound.
12. Press the AUX hold switch RH when the attachment starts moving.
13. Turn the starter switch to **[STOP]** to complete this setting.



3.3.6 Operating no-04 (AUX fine adjustment)

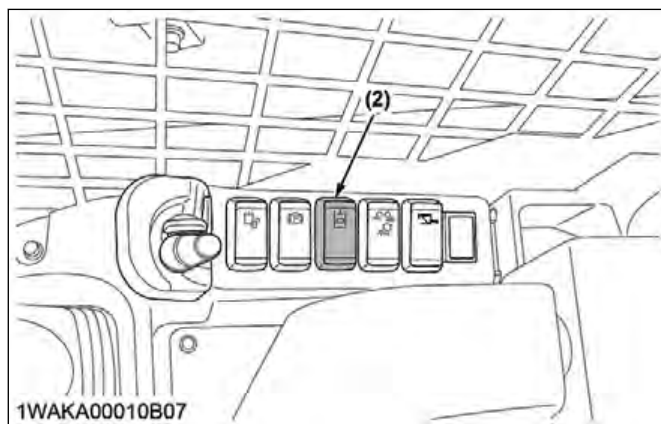
Adjusts the AUX operation feeling in the case that the feeling is out of alignment with the actual attachment movement.

1. Press the AUX hold switch RH or LH to select "no-04" in the service dealer mode.
2. Press and hold the AUX hold switch RH to enter "no-04".
3. "4:---" is displayed.
4. Start the engine and press the hydraulic unlock switch.



(1) Hydraulic unlock switch

5. Press the AUX switch to enable the AUX.



(2) AUX switch

6. When "L: 0" is displayed and the AUX lamp lights up, increase the engine speed to the maximum.
7. Select the number from -40 to 40.

NOTE

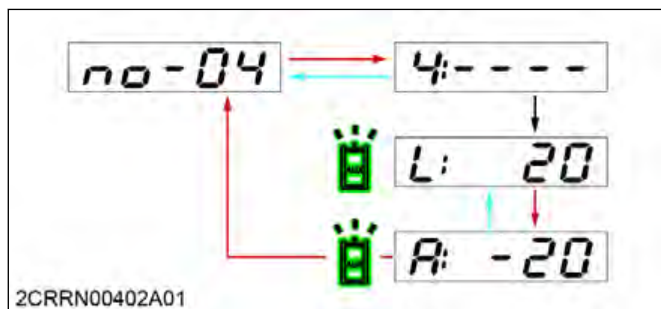
- Increase the number: press the AUX hold switch RH
- Decrease the number: press the AUX hold switch LH

8. Press and hold the AUX hold switch RH.
9. "R: 0" is displayed. Select the number from -40 to 40.

NOTE

- Increase the number: press the AUX hold switch RH
- Decrease the number: press the AUX hold switch LH

10. A buzzer beeps, and it returns to "no-04".
11. Turn the starter switch to [STOP] to complete this setting.



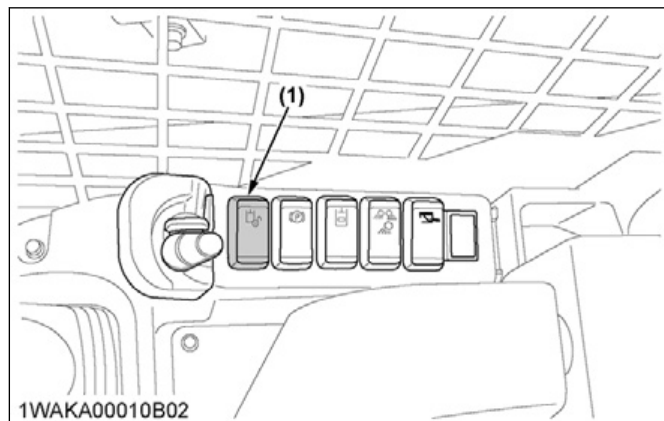
3.3.7 Operating no-05 (HST start-up point setting)

Adjusts the start-up point for traveling.

CAUTION

- The machine moves forward in this setting. Make sure that the area around the machine is free of any persons or obstructions.

1. Press the AUX hold switch RH or LH to select "no-05" in the service dealer mode.
2. Press and hold the AUX hold switch RH to enter "no-05".
3. "5:--" is displayed.
4. Start the engine and keep it at idling speed. Press the hydraulic unlock switch.



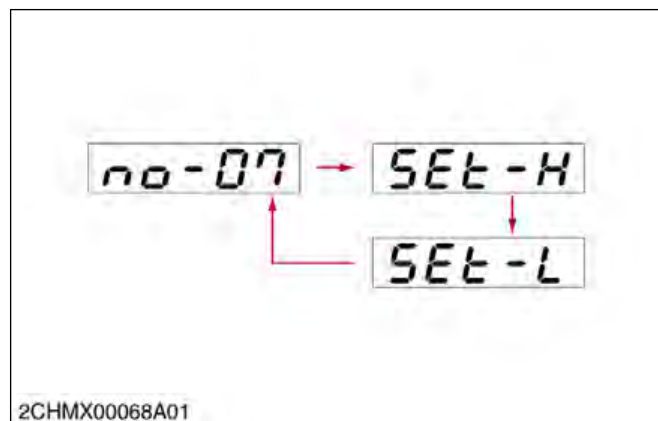
(1) Hydraulic unlock switch

5. "set.." is displayed. Press the AUX hold switch RH.
6. "set-3" is displayed. Tilt and hold the travel control lever to the forward direction at full stroke.
7. After several tens of seconds, the machine moves forward gradually. Press the AUX hold switch RH when the machine starts moving.
8. "set-2" is displayed. Tilt and hold the travel control lever to the forward direction at full stroke.
9. After several tens of seconds, the machine moves forward gradually. Press the AUX hold switch RH when the machine starts moving.
10. "set-1" is displayed. Tilt and hold the travel control lever to the forward direction at full stroke.
11. After several tens of seconds, the machine moves forward gradually. Press the AUX hold switch RH when the machine starts moving.
12. "OFF" is displayed. Turn the starter switch to [STOP] to complete this setting.

3.3.8 Operating no-07 (Accelerator pedal and dial setting)

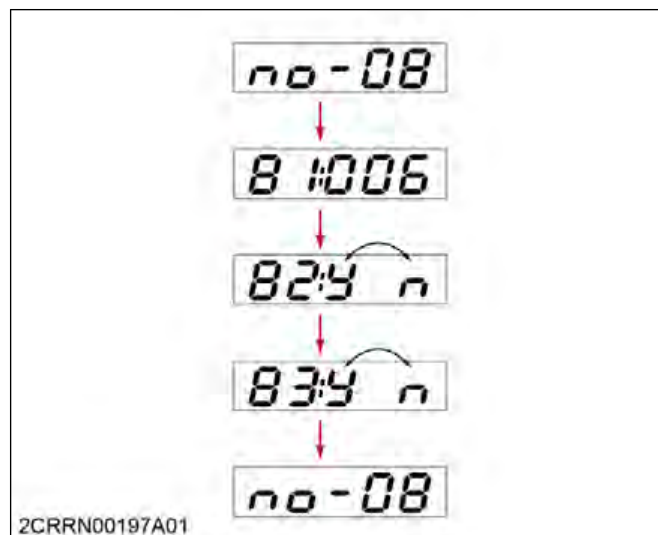
1. Press the AUX hold switch RH or LH to select "no-07" in the service dealer mode.
2. Press and hold the AUX hold switch RH to enter "no-07".
3. When "SET-H" is displayed, fully depress and hold the accelerator pedal, turn and hold the accelerator dial to the maximum position, and press and hold the AUX hold switch RH.
4. When "SET-L" is displayed, release the accelerator pedal to let it go back to the minimum position, and turn the accelerator dial to the minimum position. Then press and hold the AUX hold switch RH.

5. A buzzer beeps, and it returns to "no-07".



3.3.9 Operating no-08 (Model setting)

1. Press the AUX hold switch RH or LH to select "no-08" in the service dealer mode.
2. Press and hold the AUX hold switch RH to enter "no-08".
3. Set the following 3 items: model, AUX flow, and accelerator specification.
4. After completing the model setting, a buzzer beeps, and it returns to "no-08".



81. Model

Display	Model
"003"	SVL75-2
"004"	SVL90-2
"006"	SVL65-2

82. AUX flow

Display	AUX flow
"y"	High-flow
"n"	Normal flow

83. Accelerator specification

Display	Accelerator specification
"y"	Accelerator dial and pedal
"n"	Accelerator lever and pedal

NOTE

- Select "y" for accelerator specification of this machine since the accelerator lever is not equipped.

3.3.10 Operating no-09 (Reading error history)

Displays the previous error codes and hour meters from the memory.

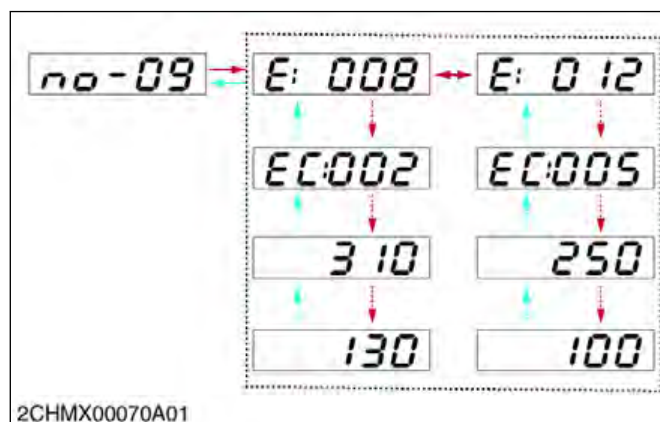
NOTE

- Displays 3 items for each error code.
 - Number of occurrences
 - Hour meter indication at the most recent occurrence
 - Hour meter indication at the first occurrence
 - Use "no-10" to clear the error history.
- Press the AUX hold switch RH or LH to select "no-09" in the service dealer mode.
 - Press and hold the AUX hold switch RH to enter "no-09".
 - A previous error code is displayed.
 - Press the AUX hold switch RH or LH to change the displayed item.
 - Press and hold the AUX hold switch RH to display other error codes.
 - Press and hold the AUX hold switch LH to return to "no-09".

"E:008": Issued 2 times

Hour meter indication at the most recent occurrence: 310 h

Hour meter indication at the first occurrence: 130 h



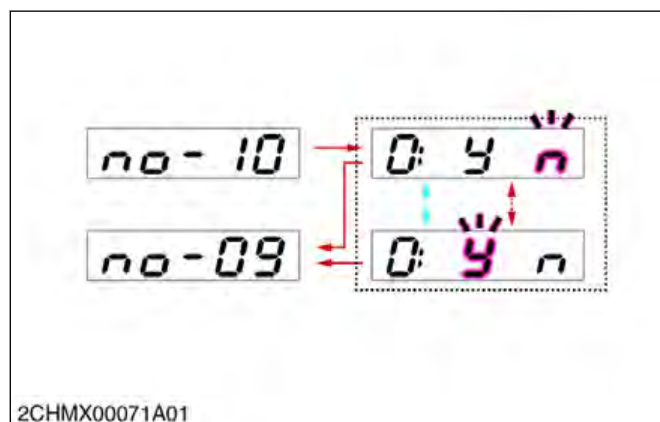
3.3.11 Operating no-10 (Clearing all error history)

Clears error history from a memory.

- Press the AUX hold switch RH or LH to select "no-10" in the service dealer mode.
- Press and hold the AUX hold switch RH to enter "no-10".
- Press AUX hold switch RH or LH to make "y" or "n" blink.
- Press and hold the AUX hold switch RH to set.

NOTE

- The error history in "no-09" (reading error history) is cleared.
- The error history in "no-11" (reading all error history) is not cleared.



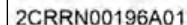
"y"	Clear
-----	-------

3.3.12 Operating no-11 (Reading all error history)

NOTE

- Displays 5 items for each error code.
 - Total number of occurrences

- Hour meter indication at the first occurrence: 130 h



SERVICING

1. Troubleshooting

1.1 Electrical troubleshooting

The starter motor does not work

Causes	Inspections	Actions
The ground terminals are disconnected or connected loosely.	Check for the connection of the relating ground terminals to the machine.	Tighten the loosened ground terminal.
The battery has discharged or is damaged.	Check for the battery voltage.	Recharge or replace the battery.
The fuse or slow blow fuse has blown.	Check if the fuses or slow blow fuses are blown.	Specify the cause of the fuse blowing and replace the fuse.
The starter relay is malfunctioning.	Check for the conduction of the starter relay.	Replace the starter relay.
The wire harnesses are damaged.	Check for the conduction of the wire harnesses related to the starter motor and starter switch.	Repair or replace the wire harness.
The starter switch is damaged.	Check for the conduction between the starter switch terminals.	Replace the starter switch.
The starter motor is malfunctioning.	Measure the voltage of the starter motor. Check for the starter motor.	Replace the starter motor.

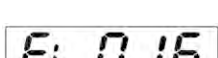
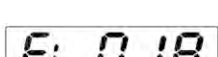
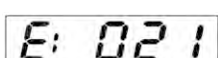
The engine does not start

Causes	Inspections	Actions
Wire harnesses are damaged.	Check for the conduction of the wire harnesses related to the starter and starter switch.	Repair or replace the wire harness.

1.2 Error warning list (Red lamp)

Display	Lamp	Error	Cause(s)	Remarks
		CAN communication error	There is no communication between the main ECU and the meter panel.	—
		Hydraulic oil temperature rising	Hydraulic oil temperature is higher than 103 °C (217 °F).	—
		High hydraulic oil temperature warning	Hydraulic oil temperature is higher than 108 °C (226 °F).	—

(Continued)

Display	Lamp	Error	Cause(s)	Remarks
		Fuel level sensor error	- The fuel level sensor is broken. - Due to the broken wiring or short circuit, hydraulic oil temperature is displayed as lower than -50 °C (-58 °F) or higher than 150 °C (302 °F).	- The fuel gauge lamp is not displayed on the meter. - The other functions of the machine are not affected.
		Accelerator dial sensor error	There is a short circuit or broken harness in the accelerator dial sensor line.	The engine speed is limited at idling.
		Travel speed shift solenoid error	There is a short circuit or broken harness in the travel speed shift solenoid line.	Travel speed shift solenoid is disabled.
		Parking brake solenoid error	There is a short circuit or broken harness in the parking brake solenoid line.	Parking brake solenoid and anti-stall proportional solenoid are disabled.
		Float solenoid error	There is a short circuit or broken harness in the float solenoid line.	Float solenoid is disabled.
		Hydraulic unlock solenoid error	There is a short circuit or broken harness in the hydraulic unlock solenoid line.	Hydraulic unlock solenoid is disabled.
		High-flow solenoid error	There is a short circuit or broken harness in the high-flow solenoid line.	High-flow solenoid is disabled.
		Hydraulic quick hitch solenoid error	There is a short circuit or broken harness in the hydraulic quick hitch solenoid line.	Hydraulic quick hitch solenoid is disabled.
		AUX knob switch error	There is a short circuit or broken harness in the AUX knob switch line.	AUX proportional solenoids are disabled.
		AUX RH solenoid error	There is a broken harness in the RHAUX solenoid line.	AUX proportional solenoids are disabled.
		AUX LH solenoid error	There is a broken harness in the LHAUX solenoid line.	AUX proportional solenoids are disabled.
		Anti-stall solenoid error	There is a short circuit or broken harness in the anti-stall solenoid line.	Anti-stall proportional solenoid and parking brake solenoid are disabled.
		5 V error	There is a short circuit in the 5 V line.	—

(Continued)

Display	Lamp	Error	Cause(s)	Remarks
		Battery charging error	Voltage of the connected battery, or the voltage from the alternator is exceeding 18 V.	Anti-stall and AUX proportional solenoids are disabled.
		Hydraulic oil temperature sensor error	There is a short circuit or broken harness in the hydraulic oil temperature sensor line.	High-flow is disabled.
		CAN communication error	There is no communication between the main ECU and engine ECU.	—
		Accelerator pedal sensor error	There is a short circuit or broken harness in the accelerator pedal sensor line.	The engine speed is limited at the idling speed.

1.3 Engine system error (Red lamp)

■ IMPORTANT

- Use Diagmaster to diagnose the engine system error in detail.
- Refer to the engine WSM or DM for engine servicing information.

Display	Lamp	Error
E:9000		DPF regeneration request (level 2)
E:9001		DPF regeneration request (level 3)
E:9002		DPF is being regenerated (level 3)
E:9003		DPF regeneration warning (level 4)
E:9004		DPF regeneration warning (level 5)
E:9006	—	DPF regeneration inhibit warning (level 2)
E:9007		DPF regeneration inhibit warning (level 3)
E:9010		Engine stop for DPF protection
E:9100		Crankshaft position sensor error Camshaft position sensor error

(Continued)

Display	Lamp	Error
E:9101		Rail pressure sensor error
E:9102		SCV error
E:9103		Intake air temperature sensor error
E:9104		Water temperature sensor error
E:9105		Fuel temperature sensor error
E:9106		Injector error
E:9107		Intake air pressure sensor error
E:9108		Battery voltage error
E:9109		Sensor voltage warning
E:9110		[ENGINE] relay error
E:9112		Atmospheric pressure sensor error
E:9113		EGR valve error
E:9114		EGR closing warning
E:9115		Emission warning (overheating)
E:9117		Glow relay error
E:9118		Engine oil pressure error
E:9119		Battery charging error

(Continued)

Display	Lamp	Error
E:9120		Water separator warning
E:9121		Engine ECU error
E:9122		CAN communication error
E:9200		Air flow sensor error
E:9203		Throttle valve error
E:9204		Differential pressure sensor error
E:9205		Exhaust gas temperature sensor error (DOC inlet)
E:9206		Exhaust gas temperature sensor error (DOC inlet)
E:9207		Exhaust gas temperature sensor error (DPF outlet)
E:9208		Simultaneous disconnection error for all exhaust gas temperature sensors
E:9211		DOC reaction error
E:9212		DPF manual regeneration time-up error
E:9213		Insufficient water temperature for DPF regeneration error
E:9214		Frequent DPF regeneration error
E:9300		Pressure limiter valve opening error
E:9301		Excessively high rail pressure error
E:9302		Fuel leakage error

(Continued)

Display	Lamp	Error
E:9303		SCV sticking error
E:9304		Supply pump high pressure error
E:9305		Insufficient intake air error
E:9306		Insufficient boost pressure error
E:9307		Exhaust gas temperature error (T0)
E:9308		Exhaust gas temperature error (T1)
E:9309		Exhaust gas temperature error (T2)
E:9310		Starter relay inhibit warning
E:9400		Others

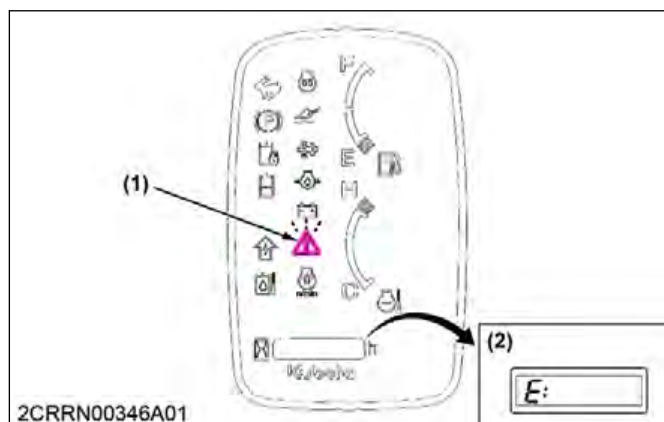
2. Handling error warning

2.1 Handling E:001CAN communication error

There is no communication between the main ECU and meter panel.

Checking the meter panel

1. Check the warning lamp and error code.



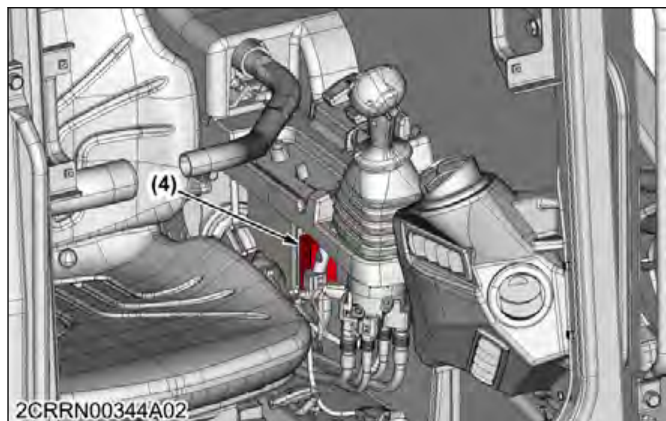
(1) Warning lamp

(2) "E:001" CAN communication error

- Check the connectors for loose connection or poor contact.
- Disconnect and reconnect the connectors and check if the error is resolved.
- Check the cover of the wiring for damage and that they are not touching the body.

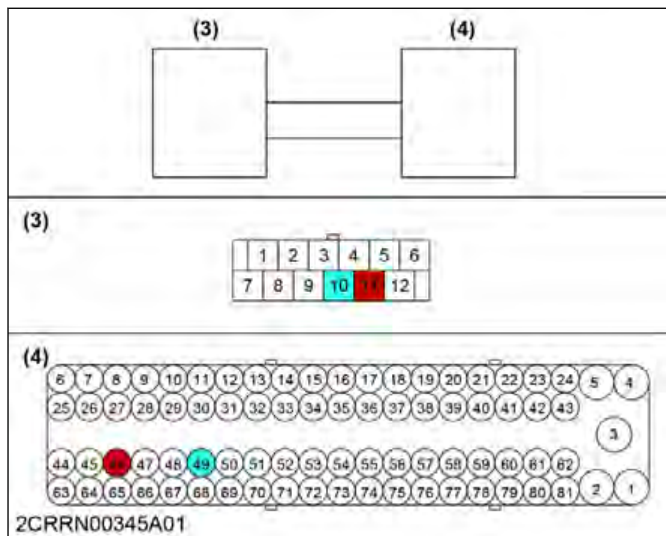
Checking the devices

1. Check the main ECU and meter panel.



(3) Meter panel connector (4) Main ECU connector

Checking the wire harness



(3) Meter panel connector (4) Main ECU connector

1. Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector and meter panel connector.

	CAN-HIGH	CAN-LOW
(3) Meter panel connector	11	10
(4) Main ECU connector	46	49

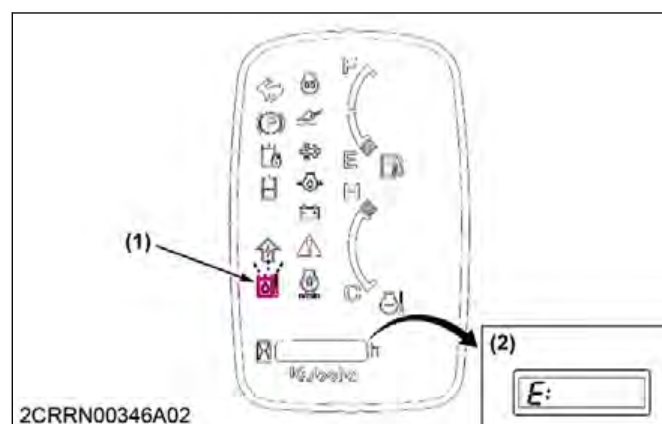
Normal	Conducting
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2.2 Handling E:004 Hydraulic oil temperature rising

The hydraulic oil temperature is between 103 °C (217 °F) and 107 °C (224 °F).

Checking the meter panel

1. Check the warning lamp and error code.



(1) Hydraulic oil temperature warning lamp (2) "E:004" Hydraulic oil temperature rising

2. Check the hydraulic oil temperature in the tester mode.

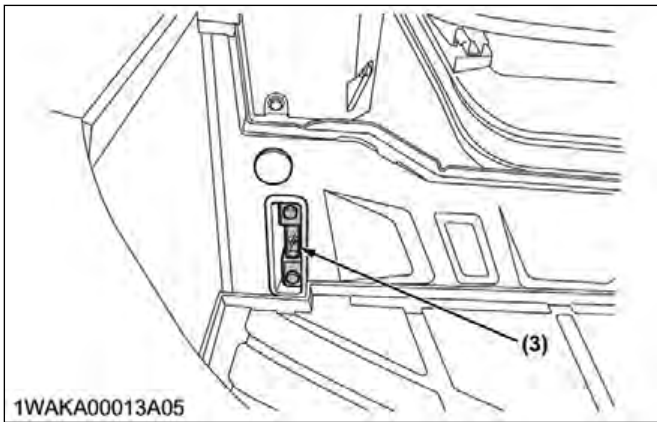
"no-01" Tester mode	"8:000.0 °C" Hydraulic oil temperature °C	Between 103 °C (217 °F) and 107 °C (224 °F)
------------------------	--	---

Checking the devices

1. Check the hydraulic oil level.

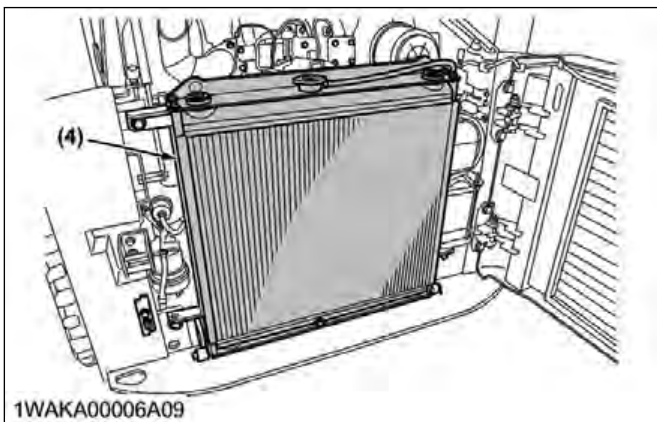
NOTE

- The hydraulic oil level needs to be at the center of the gauge.



(3) Hydraulic oil level gauge

2. Check if the fins of the oil cooler are clogged or damaged.



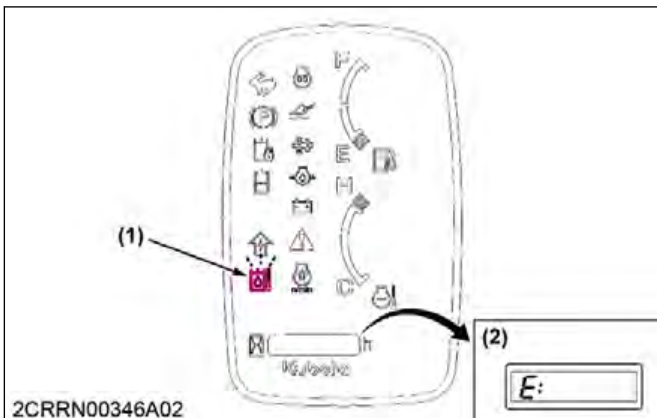
(4) Oil cooler

2.3 Handling E:005 High hydraulic oil temperature warning

The hydraulic oil temperature is higher than 108 °C (226 °F).

Checking on the meter panel

1. Check the warning lamp and error code.



(1) Hydraulic oil temperature warning lamp (2) "E:005" High hydraulic oil temperature warning

2. Check the hydraulic oil temperature in the tester mode.

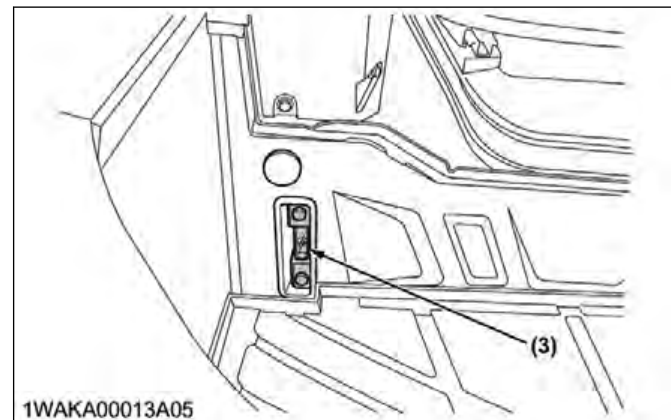
"no-01" Tester mode	"8:000.0 °C" Hydraulic oil temperature °C	Higher than 108 °C (226 °F)
------------------------	--	--------------------------------

Checking the devices

1. Check the hydraulic oil level and replenish if necessary.

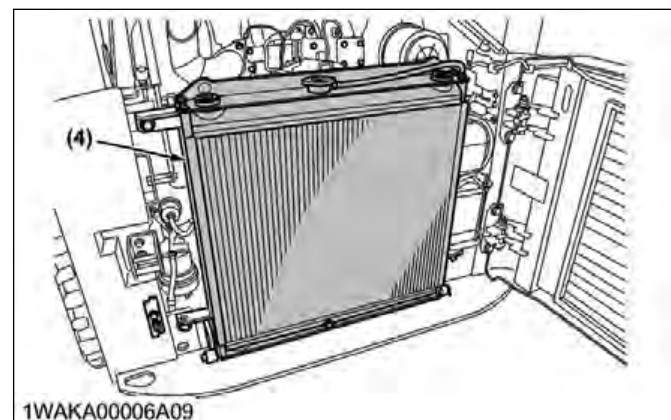
NOTE

- The hydraulic oil level needs to be at the center of the gauge.



(3) Hydraulic oil level gauge

2. Check if the fins of the oil cooler are clogged or damaged.



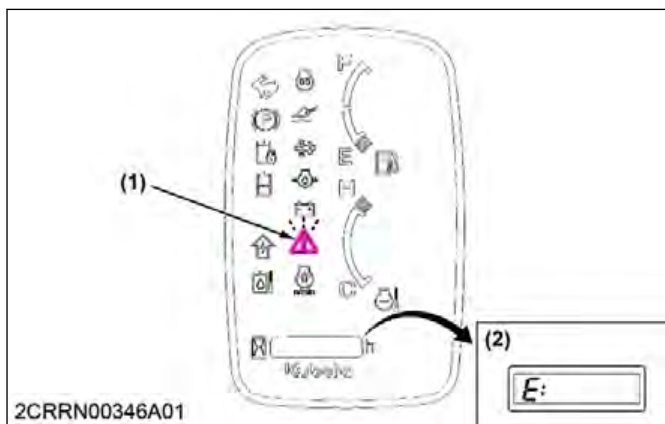
(4) Oil cooler

2.4 Handling E:008 Fuel level sensor error

Fuel level sensor resistance is displayed as over 135 Ω due to broken wiring.

Checking the meter panel

1. Check the warning lamp and error code.



(1) Warning lamp (2) "E:008" Fuel level sensor error

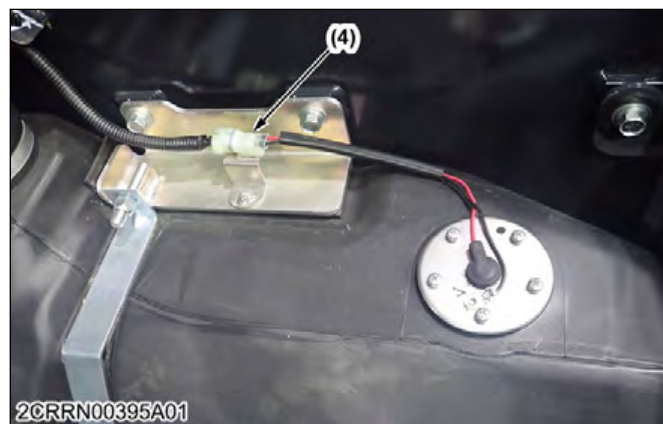
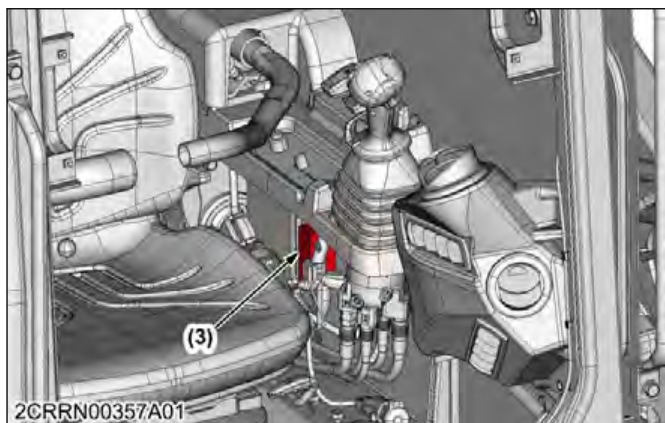
2. Check the resistance in the tester mode.

"no-01" Tester mode	"11:000 Ω" Fuel level sensor resistance	3±2 to 110±5 Ω
------------------------	---	----------------

Checking the devices

1. Check the main ECU, fuel level sensor, and joint connector.

- Check the connectors for loose connection or poor contact.
- Disconnect and reconnect the connectors and check if the error is resolved.
- Check the cover of the wiring for damage and that they are not touching the body.



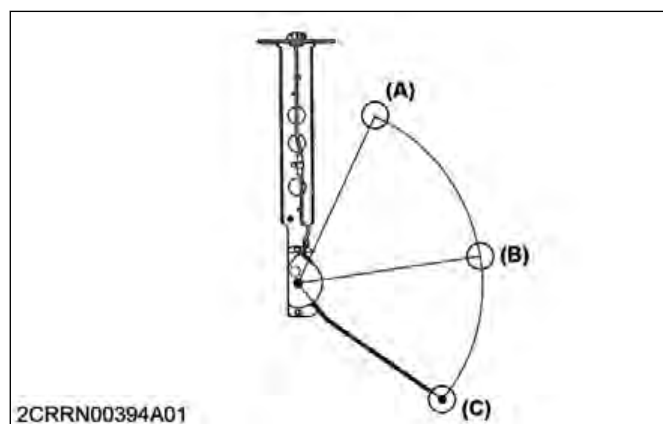
(3) Main ECU connector (4) Fuel level sensor connector



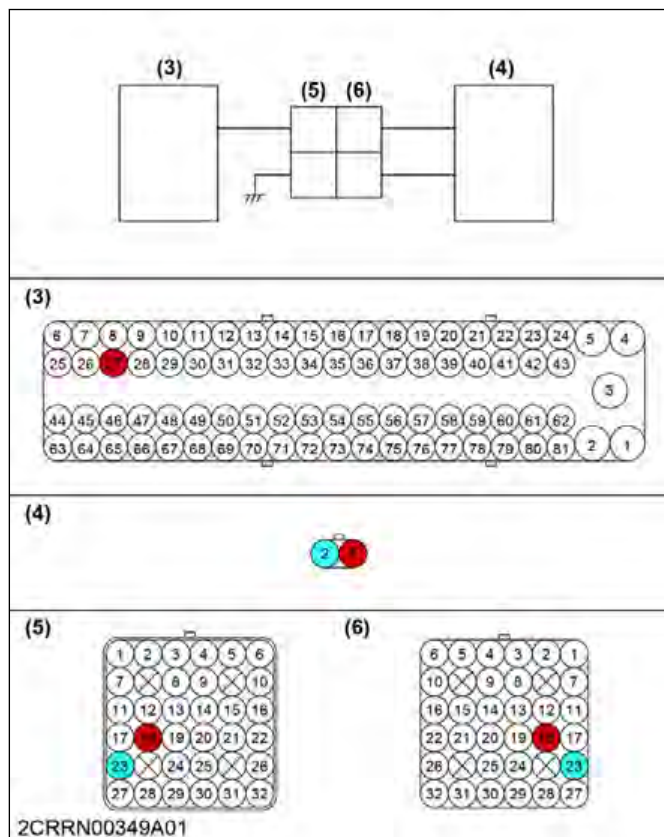
(5) Joint connector (main harness side) (6) Joint connector (engine harness side)

2. Measure the resistance of the fuel level sensor.

- Disconnect the fuel level sensor connector.



Float position	(A)	(B)	(C)
Resistance	1 to 5 Ω	33 to 43 Ω	105 to 115 Ω

Checking the wire harness

- (3) Main ECU connector (4) Fuel level sensor connector
(5) Joint connector (main harness side) (6) Joint connector (engine harness side)

- Measure the voltage of the wire harness.
 - Disconnect the fuel level sensor connector.

	(+)	(-)
(4) Fuel level sensor connector	1	2

Normal	Starter switch at [STOP]	Starter switch at [RUN]
	0 V	12 V

- Check the conduction of the wire harness.
 - Turn the starter switch to [STOP], and disconnect the main ECU connector, fuel level sensor connector and joint connector.

	12 V	GND
(3) Main ECU connector	27	—
(4) Fuel level sensor connector	1	2
(5) Joint connector (main harness side)	18	23
(6) Joint connector (engine harness side)	18	23

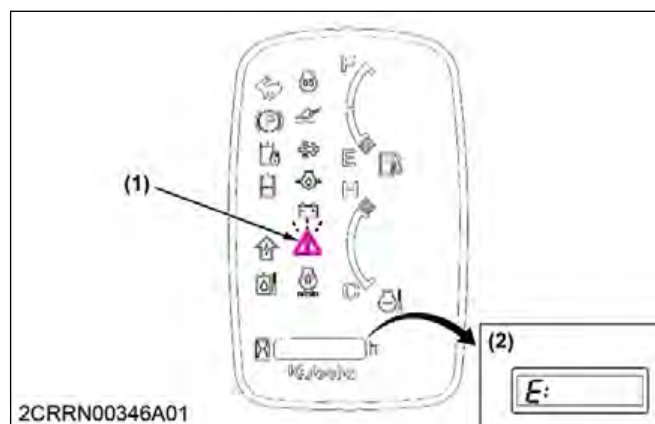
Normal	Conducting
--------	------------

2.5 Handling E:009 Accelerator dial sensor error

Short circuit or broken harness has occurred in the accelerator dial sensor line.

Checking the meter panel

- Check the warning lamp and error code.



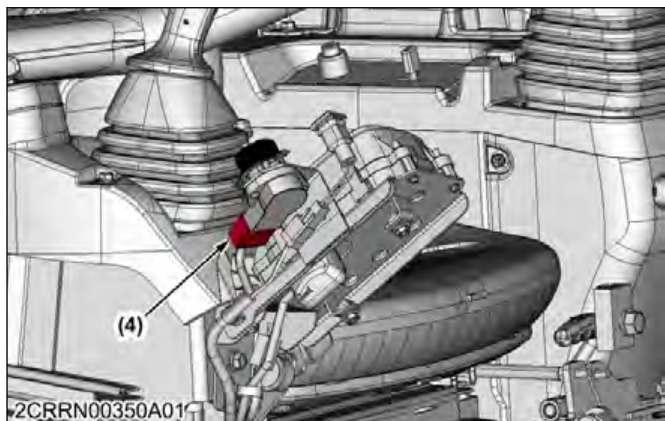
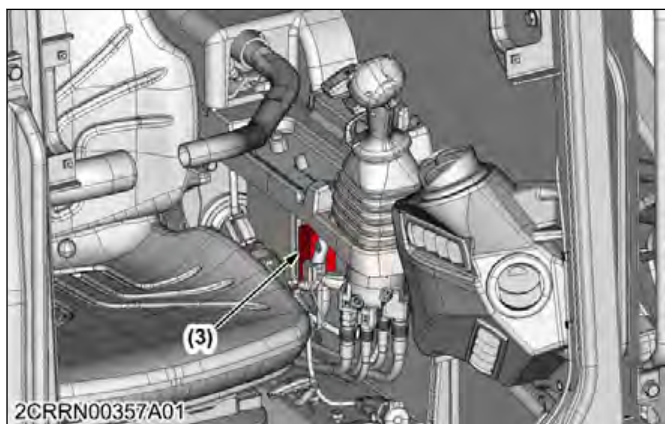
- (1) Warning lamp (2) "E:009" Accelerator dial sensor error

- Check the accelerator dial sensor voltage in the tester mode.

"no-01" Tester mode	"11: 0.00 V" Accelerator dial sensor voltage (main)	0.26 to 4.74 V
	"12: 0.00 V" Accelerator dial sensor voltage (sub)	0.26 to 4.74 V

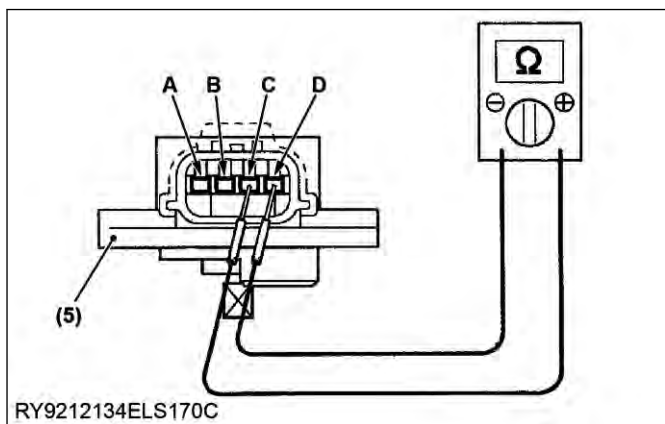
Checking the devices

- Check the main ECU and accelerator dial sensor.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector (4) Accelerator dial sensor connector

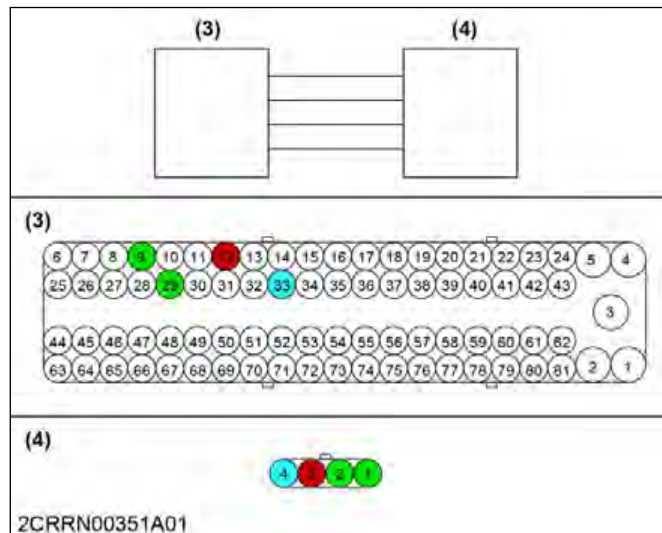
2. Measure the resistance of the accelerator dial sensor between the terminal C and D.
 - Disconnect the accelerator dial sensor connector.



(5) Accelerator dial sensor

Normal	0.8 to 1.2 kΩ
--------	---------------

Checking the wire harness



(3) Main ECU connector (4) Accelerator dial sensor connector

1. Measure the voltage of the wire harness.
 - Disconnect the accelerator dial sensor connector.

	(+)	(-)
(4) Accelerator dial sensor connector	3	4

Normal	Starter switch at [OFF]	Starter switch at [RUN]
	0 V	5 V

2. Check conduction of the wire harness.
 - Turn the starter switch to [STOP], and disconnect the main ECU connector and accelerator dial sensor connector.

	5 V	GND	Main out-put	Sub out-put
(3) Main ECU connector	12	33	29	9
(4) Accelerator dial sensor connector	3	4	2	1

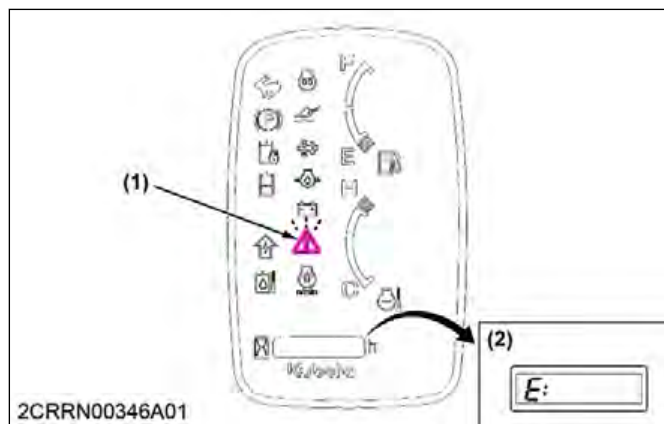
Normal	Conducting
--------	------------

2.6 Handling E:010 Travel speed shift solenoid error

Short circuit or broken harness has occurred in the travel speed shift solenoid line.

Checking the meter panel

1. Check the warning lamp and error code.

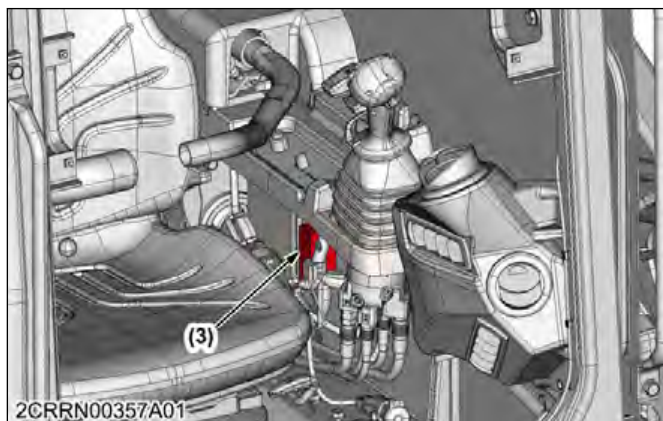


(1) Warning lamp

(2) "E:010" Travel speed shift solenoid error

Checking the devices

1. Check the main ECU, travel speed shift solenoid, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

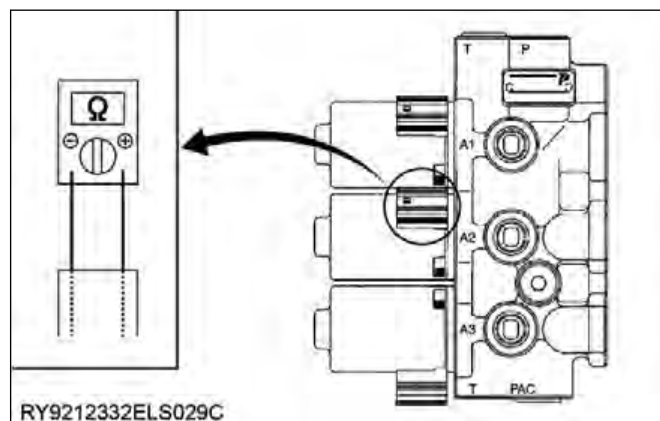
(4) Travel speed shift solenoid connector



(5) Joint connector (main harness side)

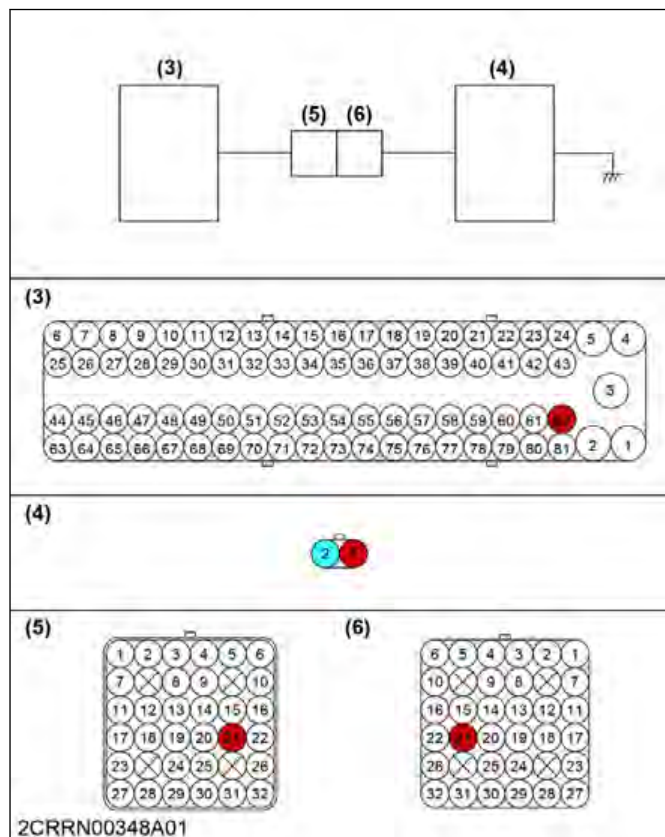
(6) Joint connector (engine harness side)

2. Measure the resistance of the travel speed shift solenoid.
 - Disconnect the travel speed shift solenoid connector.



Normal	11 to 13 Ω
--------	------------

Checking the wire harness



- (3) Main ECU connector
(4) Travel speed shift solenoid connector
(5) Joint connector (main harness side)
(6) Joint connector (engine harness side)

- Measure the voltage of the wire harness.
 - Disconnect the travel speed shift solenoid connector.

	(+)	(-)
(4) Travel speed shift solenoid connector	1	2

Normal	Low speed	High speed
	0 V	12 V

- Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, travel speed shift solenoid connector, and joint connector.

	12 V	GND
(3) Main ECU connector	62	—
(4) Travel speed shift solenoid connector	1	2
(5) Joint connector (main harness side)	21	—
(6) Joint connector (engine harness side)	21	—

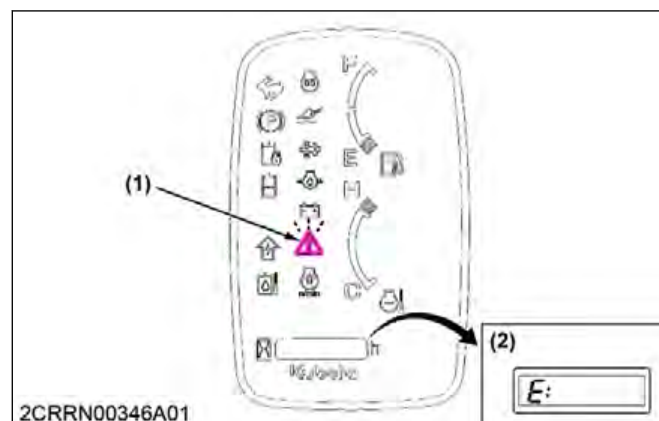
Normal	Conducting
--------	------------

2.7 Handling E:011 Parking brake solenoid error

Short circuit or broken harness has occurred in the parking brake solenoid line.

Checking on the meter panel

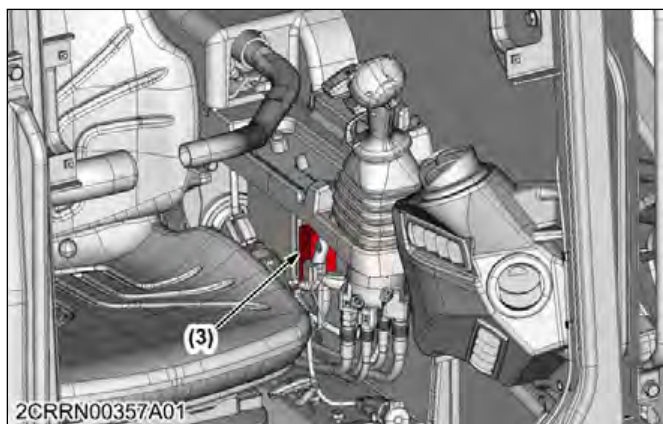
- Check the warning lamp and error code.



- (1) Warning lamp
(2) "E:011" Parking brake solenoid error

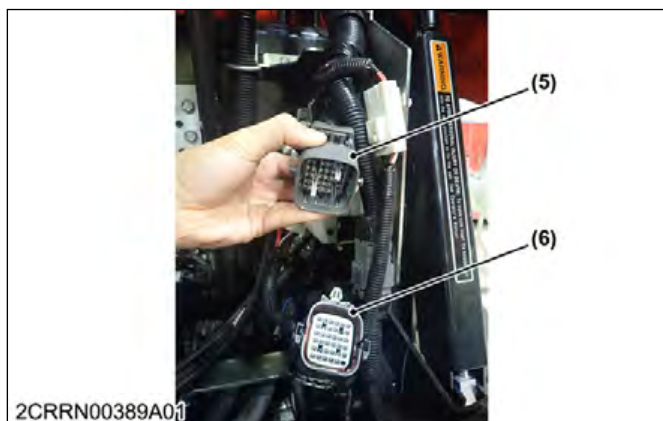
Checking the devices

- Check the main ECU, parking brake solenoid, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

(4) Parking brake solenoid connector

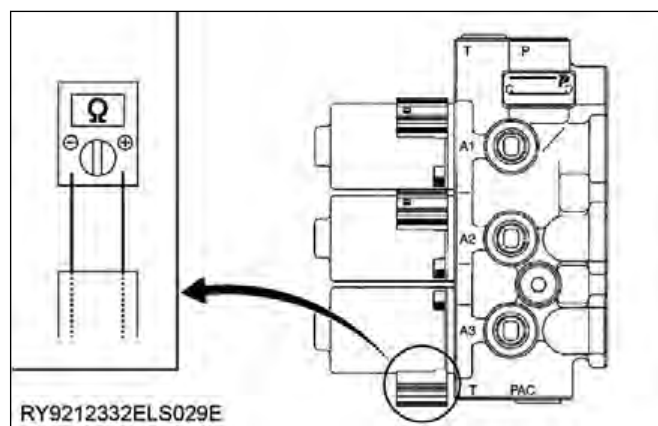


(5) Joint connector (main harness side)

(6) Joint connector (engine harness side)

2. Measure the resistance of the parking brake solenoid.

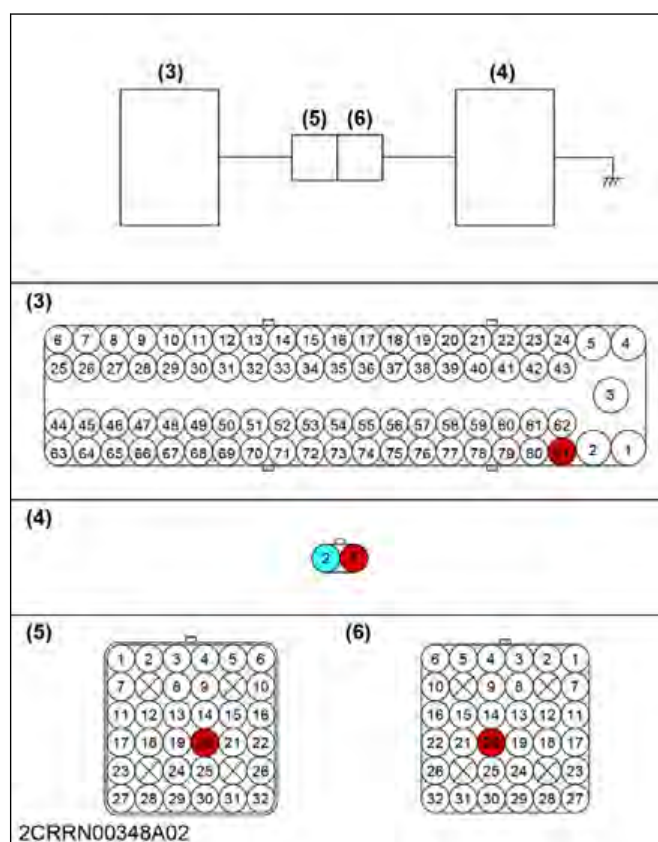
- Disconnect the parking brake solenoid connector.



Normal

11 to 13 Ω

Checking the wire harness



(3) Main ECU connector

(4) Parking brake solenoid connector

(5) Joint connector (main harness side)

(6) Joint connector (engine harness side)

1. Measure the voltage of the wire harness.

- Disconnect the parking brake solenoid connector.

	(+)	(-)
(4) Parking brake solenoid connector	1	2

Normal	Parking brake lamp OFF	Parking brake lamp ON
	12 V	0 V

2. Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, parking brake solenoid connector, and joint connectors.

	12 V	GND
(3) Main ECU connector	81	—
(4) Parking brake solenoid connector	1	2
(5) Joint connector (main harness side)	20	—
(6) Joint connector (engine harness side)	20	—

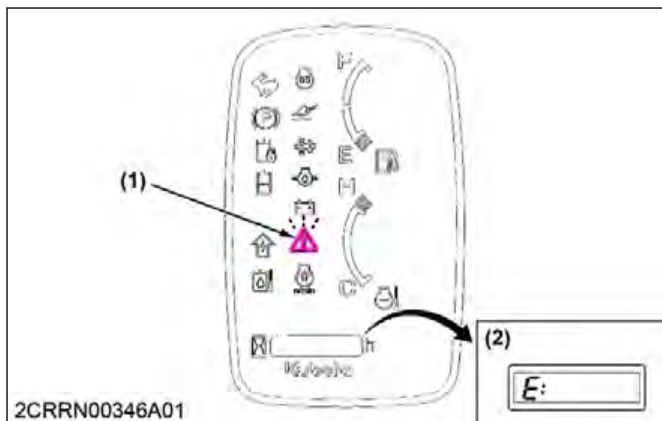
Normal	Conducting
--------	------------

2.8 Handling E:012 Float solenoid error

Short circuit or broken harness has occurred in the float solenoid line.

Checking on the meter panel

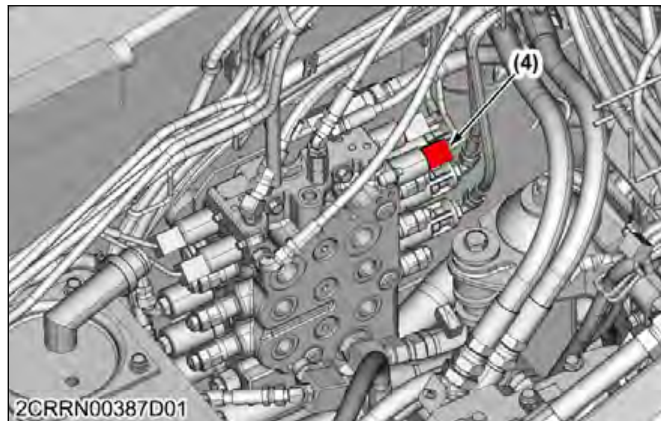
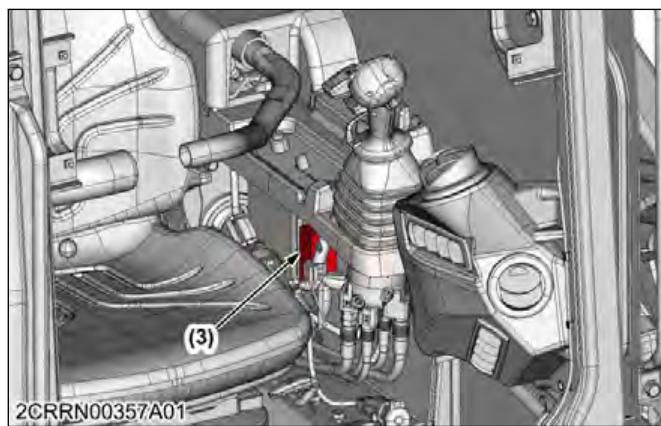
1. Check the warning lamp and error code.



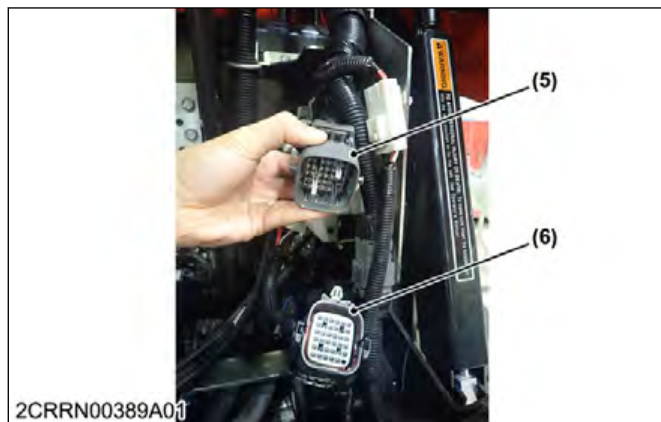
(1) Warning lamp (2) "E:012" Float solenoid error

Checking the devices

1. Check the main ECU connector, float solenoid connector, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.

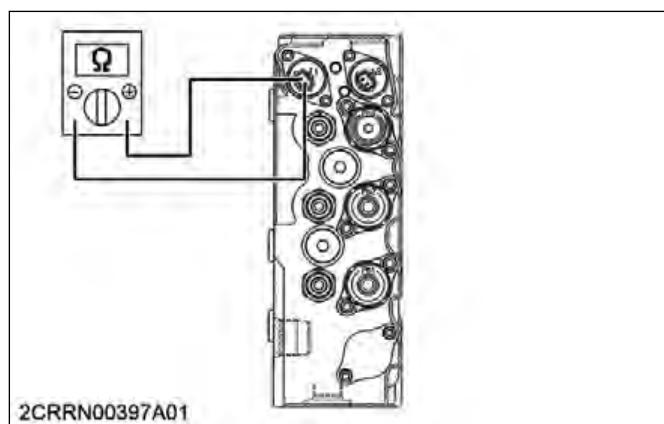


(3) Main ECU connector (4) Float solenoid connector



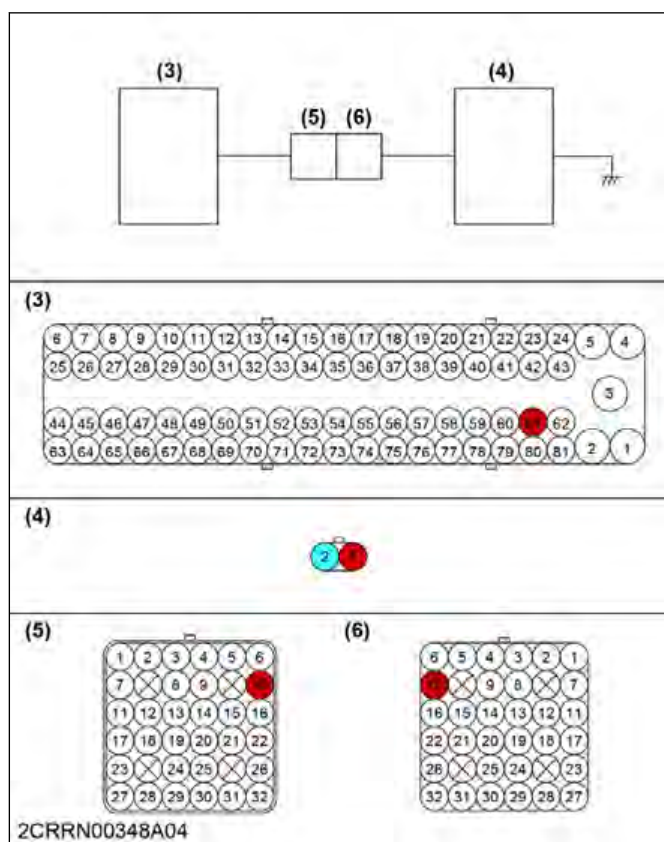
(5) Joint connector (main harness side) (6) Joint connector (engine harness side)

2. Measure the resistance of the float solenoid.
 - Disconnect the float solenoid connector.



Normal	Approximately 2.9 Ω
--------	---------------------

Checking the wire harness



- (3) Main ECU connector (4) Float solenoid connector
(5) Joint connector (main harness side) (6) Joint connector (engine harness side)

- Measure the voltage of the wire harness.
 - Disconnect the float solenoid connector.

	(+)	(-)
(4) Float solenoid connector	1	2

Normal	Float OFF	Float ON
	0 V	12 V

- Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, float solenoid connector, and joint connector.

	12 V	GND
(3) Main ECU connector	61	—
(4) Float solenoid connector	1	2
(5) Joint connector (main harness side)	10	—
(6) Joint connector (engine harness side)	10	—

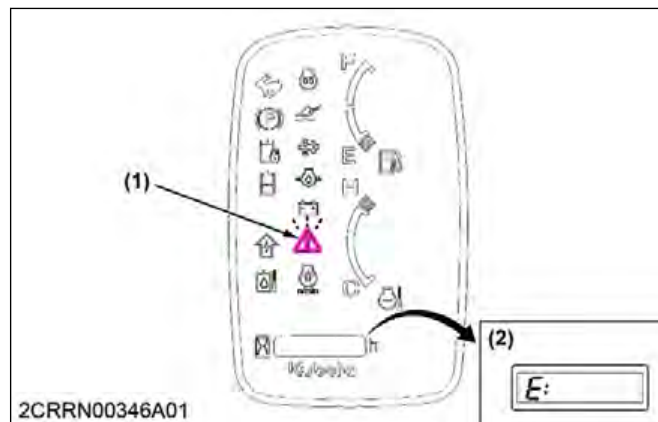
Normal	Conducting
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2.9 Handling E:013 Hydraulic unlock solenoid error

Short circuit or broken harness has occurred in the hydraulic unlock solenoid line.

Checking on the meter panel

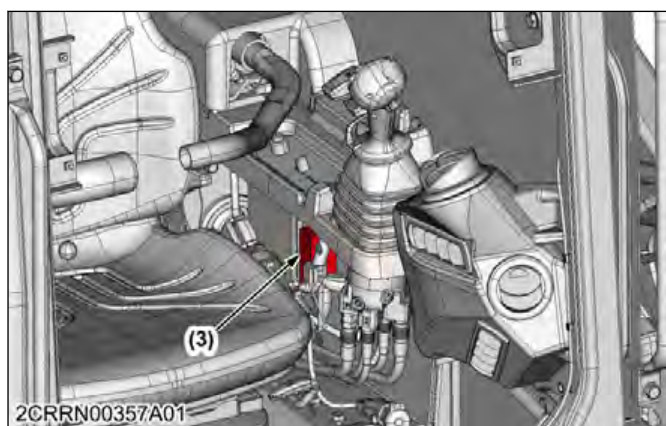
- Check the warning lamp and error code.



- (1) Warning lamp (2) "E:013" Hydraulic unlock solenoid error

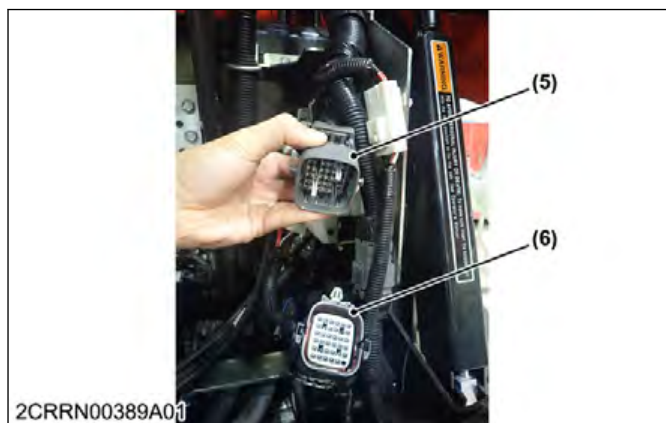
Checking the devices

- Check the main ECU, hydraulic unlock solenoid, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

(4) Hydraulic unlock solenoid connector

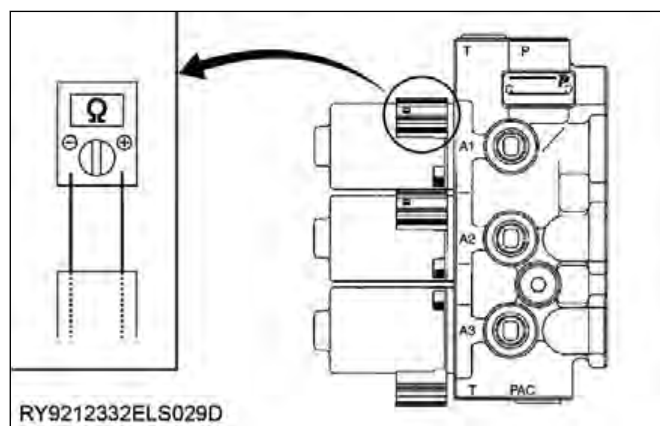


(5) Joint connector (main harness side)

(6) Joint connector (engine harness side)

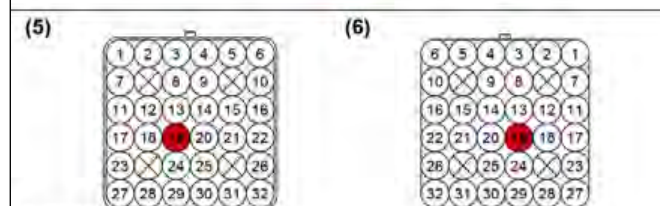
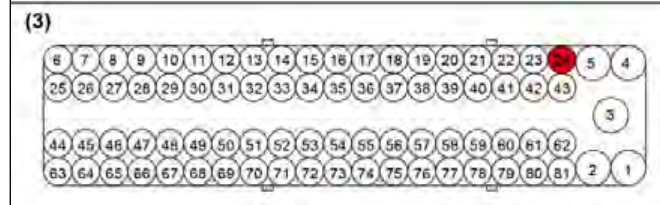
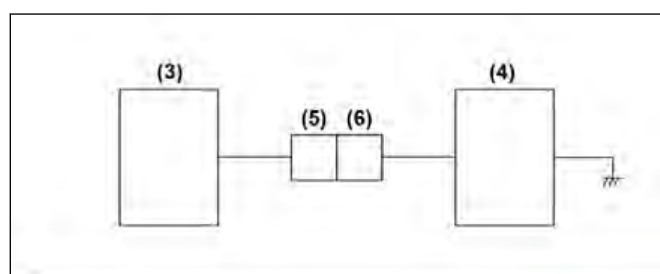
2. Measure the resistance of the hydraulic unlock solenoid.

- Disconnect the hydraulic unlock solenoid connector.



Normal	11 to 13 Ω
--------	------------

Checking the wire harness



2CRRN00348A03

- (3) Main ECU connector
(4) Hydraulic unlock solenoid connector
(5) Joint connector (main harness side)
(6) Joint connector (engine harness side)

1. Measure the voltage of the wire harness.
- Disconnect the hydraulic unlock solenoid connector.

	(+)	(-)
(4) Hydraulic unlock solenoid connector	1	2

Normal	Hydraulic system locked	Hydraulic system unlocked
	0 V	12 V

2. Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, hydraulic unlock solenoid connector, and joint connector.

	12 V	GND
(3) Main ECU connector	24	—
(4) Hydraulic unlock solenoid connector	1	2
(5) Joint connector (main harness side)	19	—
(6) Joint connector (engine harness side)	19	—

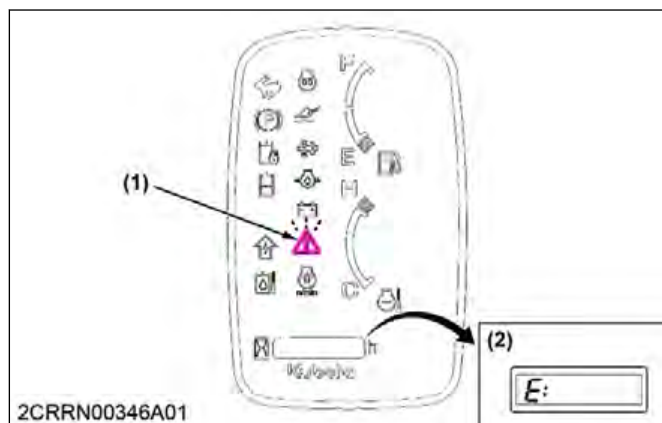
Normal	Conducting
--------	------------

2.10 Handling E:014 High-flow solenoid error

Short circuit or broken harness has occurred in the high-flow solenoid line.

Checking on the meter panel

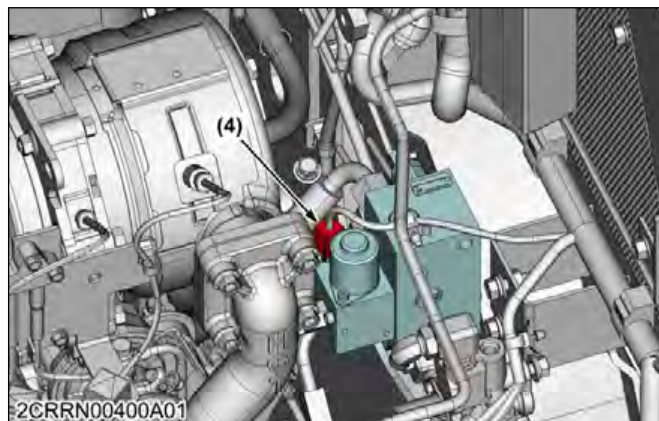
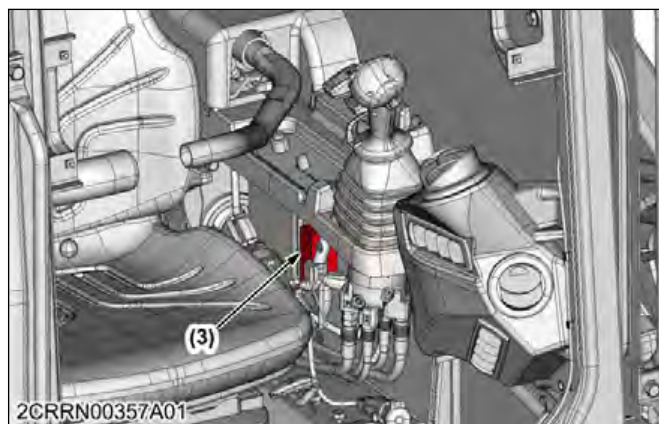
1. Check the warning lamp and error code.



- (1) Warning lamp (2) "E:014" High-flow solenoid error

Checking the devices

1. Check the main ECU, high-flow solenoid, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.

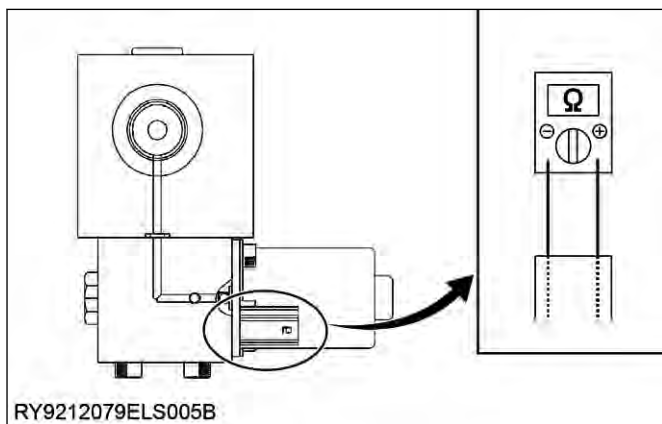


- (3) Main ECU connector (4) High-flow solenoid connector



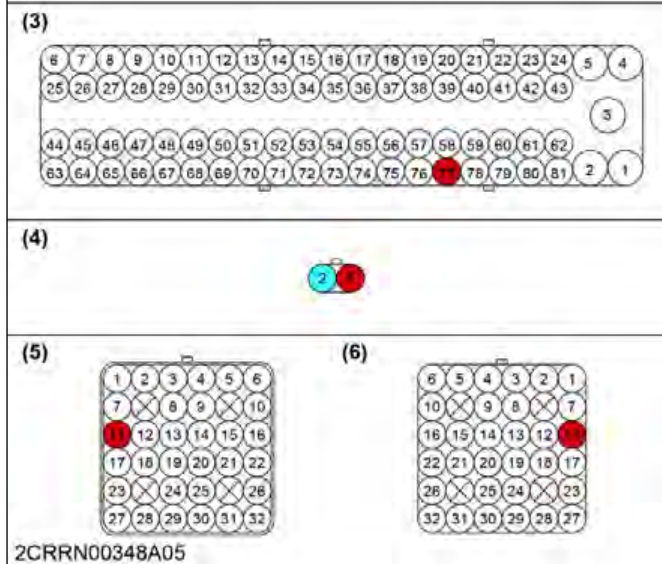
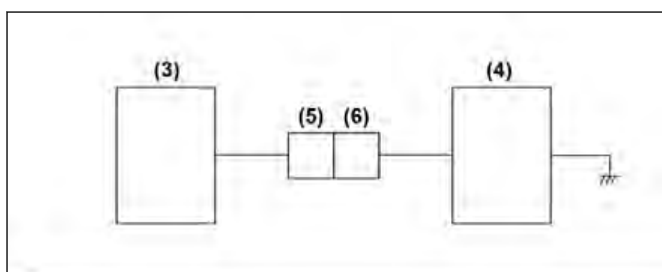
- (5) Joint connector (main harness side) (6) Joint connector (engine harness side)

2. Measure the resistance of the high-flow solenoid.
 - Disconnect the high-flow solenoid connector.



Normal	11 to 13 Ω
--------	------------

Checking the wire harness



- (3) Main ECU connector (6) Joint connector (engine harness side)
(4) High-flow solenoid connector
(5) Joint connector (main harness side)

- Measure the voltage of the wire harness.
 - Disconnect the high-flow solenoid connector.

	(+)	(-)
(4) High-flow solenoid connector	1	2

Normal	High-flow OFF	High-flow ON
	0 V	12 V

- Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, high-flow solenoid connector, and joint connector.

	12 V	GND
(3) Main ECU connector	77	—
(4) High-flow solenoid connector	1	2
(5) Joint connector (main harness side)	11	—
(6) Joint connector (engine harness side)	11	—

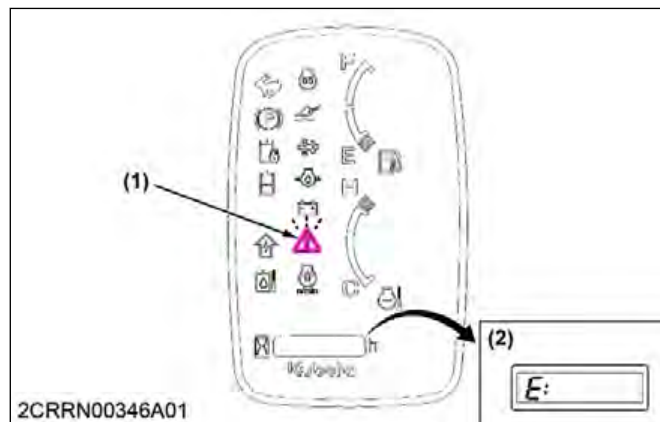
Normal	Conducting
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2.11 Handling E:015 Hydraulic quick hitch solenoid error

Short circuit has occurred in the hydraulic quick hitch solenoid line.

Checking on the meter panel

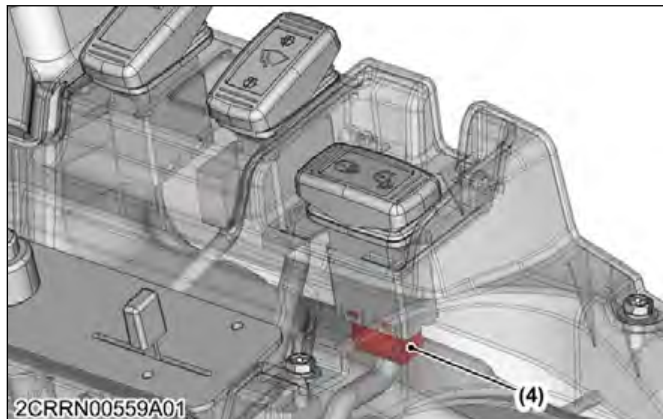
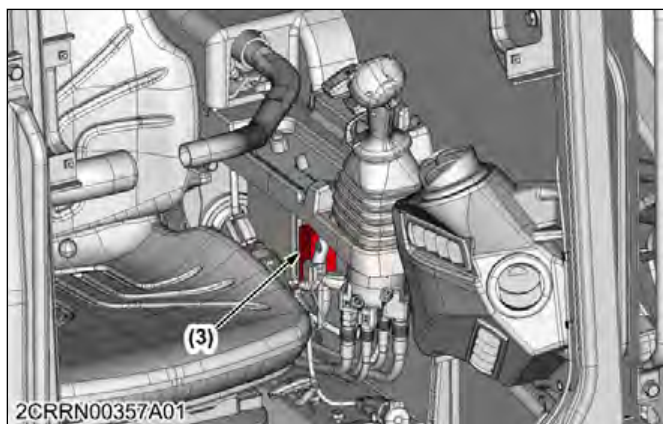
- Check the warning lamp and error code.



- (1) Warning lamp (2) "E:015" Hydraulic quick hitch solenoid error

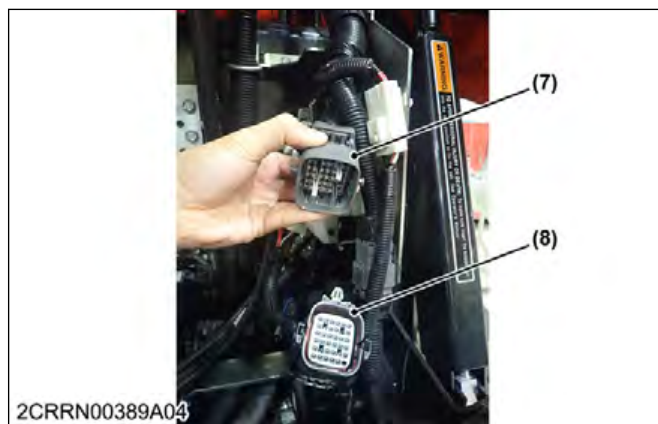
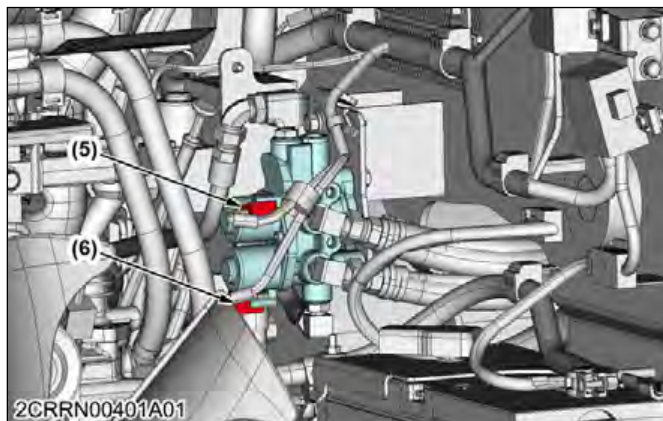
Checking the devices

- Check the main ECU, hydraulic quick hitch switch, hydraulic quick hitch solenoid, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

(4) Hydraulic quick hitch switch connector



(5) Hydraulic quick hitch solenoid connector (unlock)

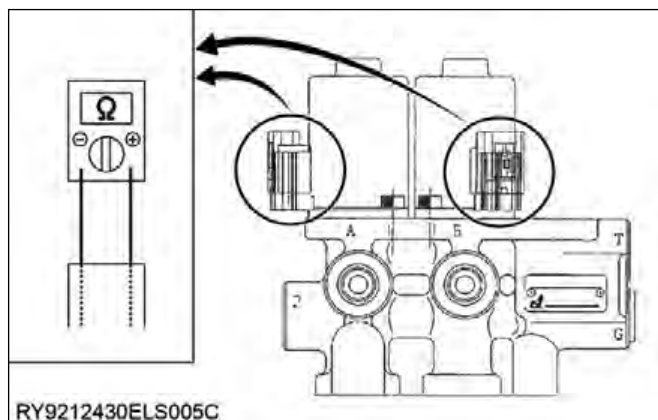
(8) Joint connector (engine harness side)

(6) Hydraulic quick hitch solenoid connector (lock)

(7) Joint connector (main harness side)

2. Measure the resistance of the hydraulic quick hitch solenoid.

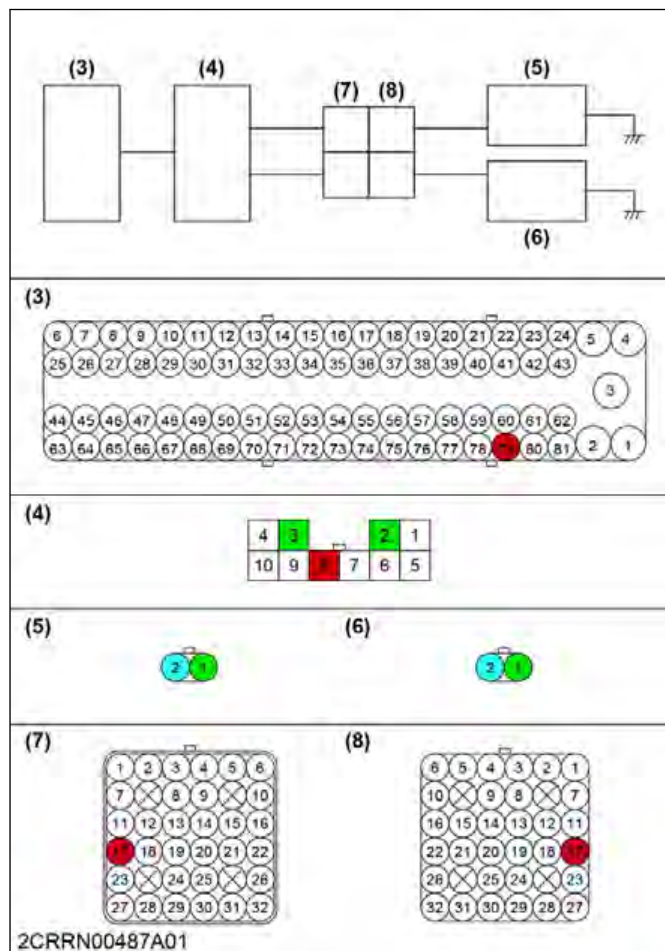
- Disconnect the hydraulic quick hitch solenoid connector.



Normal

11 to 13 Ω

Checking the wire harness



- (3) Main ECU connector
(4) Hydraulic quick hitch switch connector
(5) Hydraulic quick hitch solenoid connector (unlock)
(6) Hydraulic quick hitch solenoid connector (lock)
(7) Joint connector (main harness side)
(8) Joint connector (engine harness side)

- Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector and hydraulic quick hitch solenoid connectors.

Conduction between the main ECU and hydraulic quick hitch switch connector

	12 V	GND
(3) Main ECU connector	79	—
(4) Hydraulic quick hitch switch connector	8	—

Conduction between the hydraulic quick hitch switch connector and hydraulic quick hitch solenoid connector

	12 V	GND
(4) Hydraulic quick hitch switch connector	2 3	—
(5) Hydraulic quick hitch solenoid connector (unlock)	1 (30)	2
(6) Hydraulic quick hitch solenoid connector (lock)	1 (17)	2

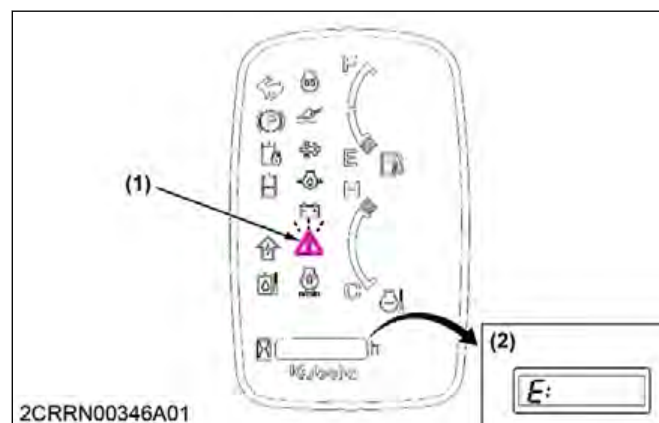
Normal	Conducting
--------	------------

2.12 Handling E:016AUX knob switch error

Short circuit or broken harness has occurred in the AUX knob switch line.

Checking on the meter panel

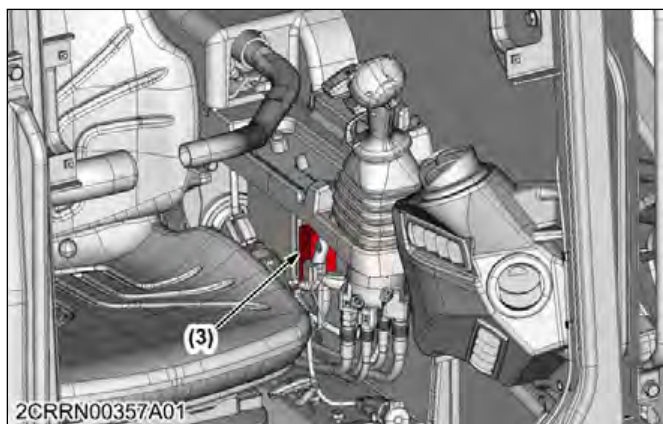
- Check the warning lamp and error code.



- (1) Warning lamp
(2) "E:016" AUX knob switch error

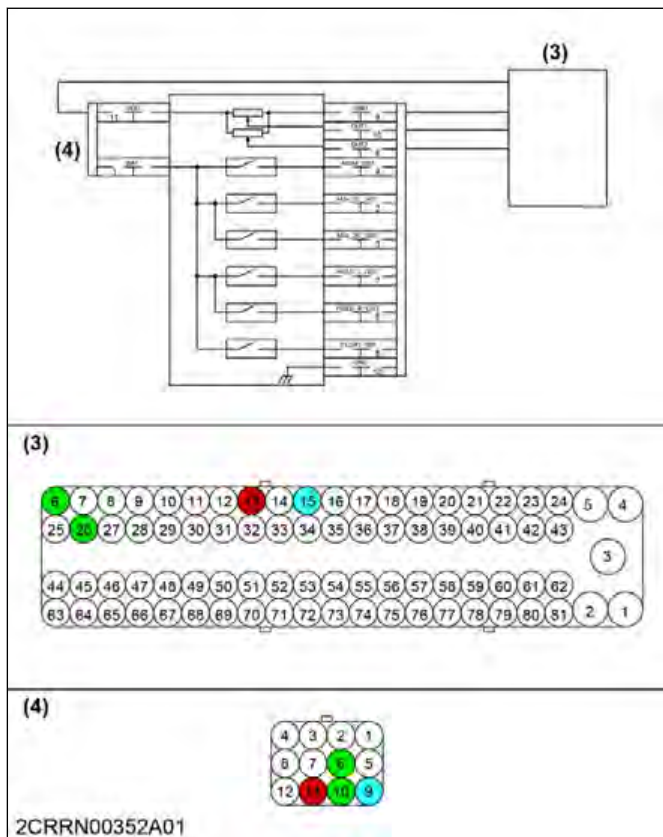
Checking the devices

- Check the main ECU and control lever RH.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

(4) Control lever RH connector

Checking the wire harness

(3) Main ECU connector

(4) Control lever RH connector

1. Check the voltage of the wire harness.
 - Disconnect the control lever RH connector.

	(+)	(-)
(4) Control lever RH connector	11	9

Normal	Starter switch at [STOP]	Starter switch at [RUN]
	0 V	5 V

2. Check the conduction of the wire harness.
 - Turn the starter switch to [STOP], and disconnect the main ECU connector and control lever RH connector.

	+5 V	GND (Blue)	Signal (main)	Signal (sub)
(3) Main ECU connector	13	15	6	26
(4) Control lever RH connector	11	9	10	6

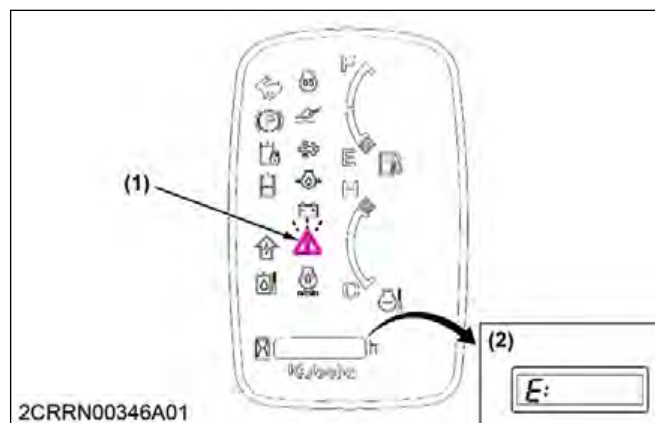
Normal	Conducting
--------	------------

2.13 Handling E:018AUXRH proportional solenoid error

Broken harness has occurred in the AUXRH proportional solenoid line.

Checking on the meter panel

1. Check the warning lamp and error code.



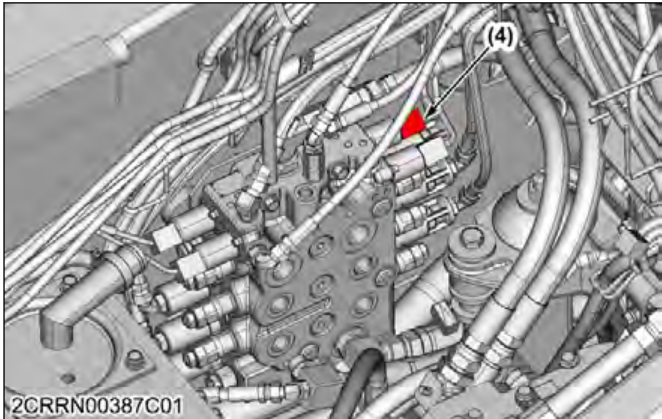
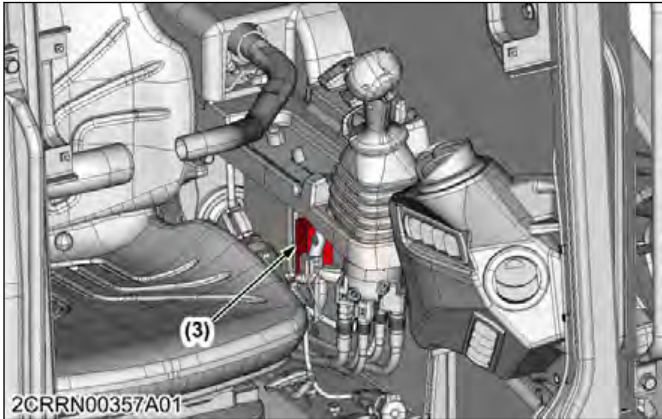
(1) Warning lamp

(2) "E:018" CAN communication error

Checking the devices

1. Check the main ECU, AUXRH proportional solenoid, and joint connector.
 - Check the connectors for loose connection or poor contact.

- Disconnect and reconnect the connectors and check if the error is resolved.
- Check the cover of the wiring for damage and that they are not touching the body.

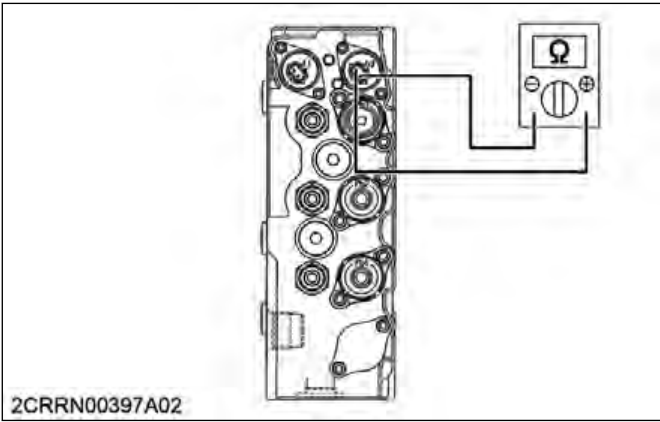


(3) Main ECU connector (4) AUX RH proportional solenoid



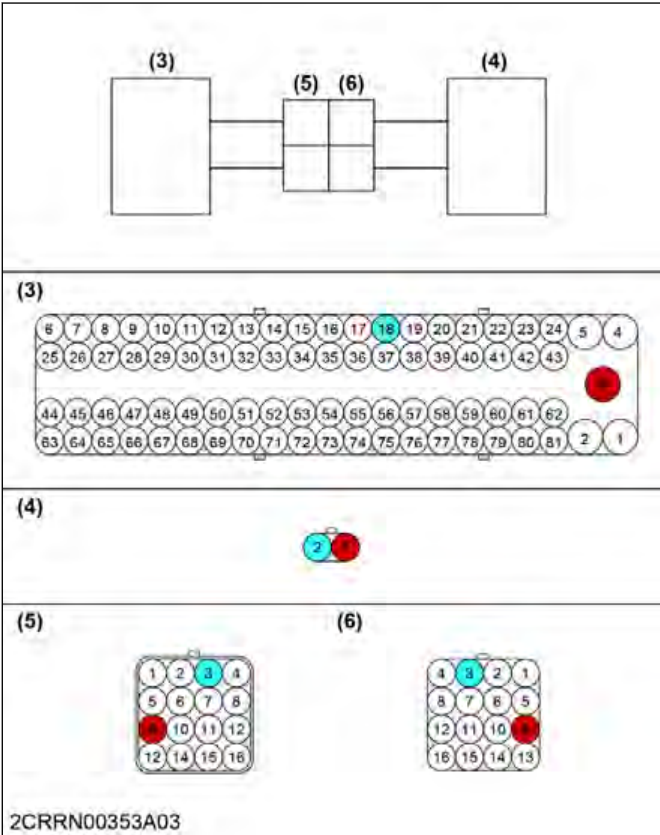
(5) Joint connector (main harness side) (6) Joint connector (engine harness side)

2. Measure the resistance of the AUXRH proportional solenoid.
- Disconnect the AUXRH proportional solenoid connector.



Normal	Approximately 2.9 Ω
--------	---------------------

Checking the wire harness



- (3) Main ECU connector (4) RH AUX proportional solenoid connector (5) Joint connector (main harness side) (6) Joint connector (engine harness side)

1. Measure the voltage of the wire harness.
- Disconnect the AUXRH proportional solenoid connector.

	(+)	(-)
(4) AUXRH proportional solenoid connector	1	2

Normal	AUX OFF	AUX hold SW RH ON
	0 V	12 V

2. Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, AUXRH proportional solenoid connector, and joint connector.

	12 V	GND
(3) Main ECU connector	3	18
(4) RHAUX proportional solenoid connector	1	2
(5) Joint connector (main harness side)	9	3
(6) Joint connector (engine harness side)	9	3

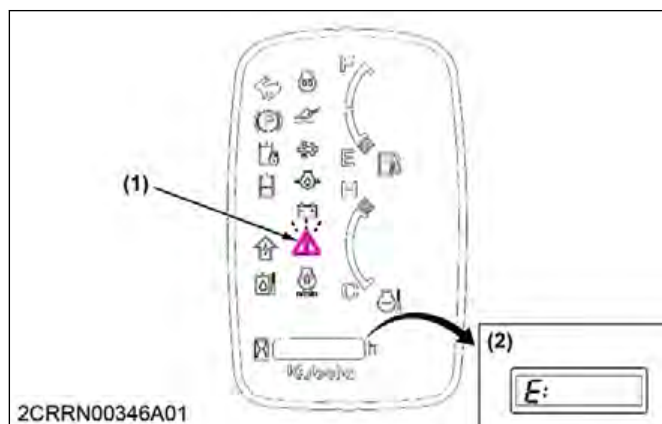
Normal	Conducting
--------	------------

2.14 Handling E:019AUXLH proportional solenoid error

Broken harness has occurred in the AUXLH proportional solenoid line.

Checking on the meter panel

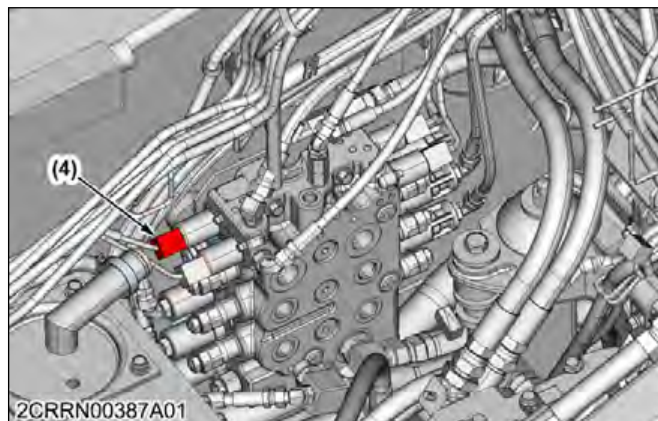
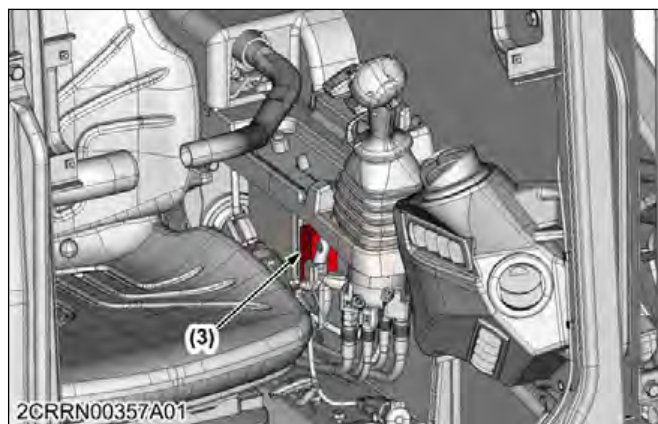
1. Check the warning lamp and error code.



- (1) Warning lamp (2) "E:019" AUX LH proportional solenoid error

Checking the devices

1. Check the main ECU, AUXLH proportional solenoid, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

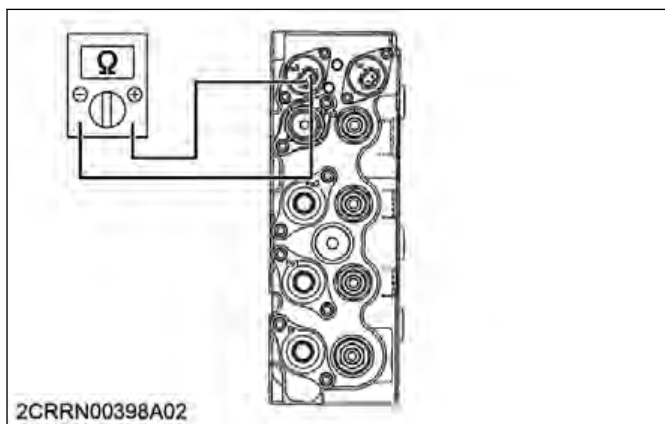
(4) AUX LH proportional solenoid connector



(5) Joint connector (main harness side)

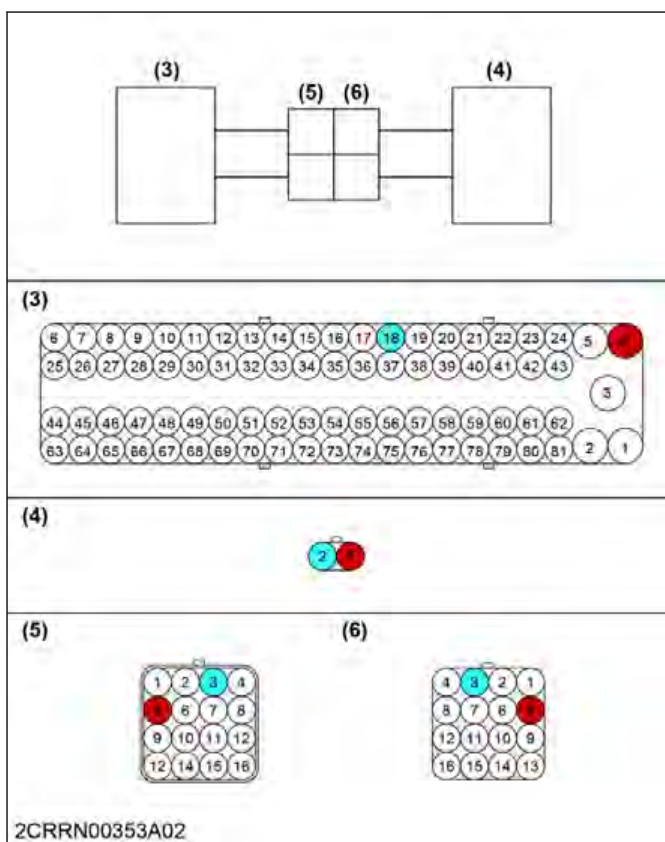
(6) Joint connector (engine harness side)

2. Measure the resistance of the AUXLH proportional solenoid.
 - Disconnect the AUXLH proportional solenoid connector.



Normal	Approximately 2.9 Ω
--------	---------------------

Checking the wire harness



- (3) Main ECU connector
(4) AUX LH proportional solenoid connector
(5) Joint connector (main harness side)
(6) Joint connector (engine harness side)

- Measure the voltage of the wire harness.
 - Disconnect the AUXLH proportional solenoid connector.

	(+)	(-)
(4) AUXLH proportional solenoid connector	1	2

Normal	AUX OFF	AUX hold SW LH ON
	0 V	12 V

- Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, AUXLH proportional solenoid connector, and joint connector.

	12 V	GND
(3) Main ECU connector	4	18
(4) AUXLH proportional solenoid connector	1	2
(5) Joint connector (main harness side)	5	3
(6) Joint connector (engine harness side)	5	3

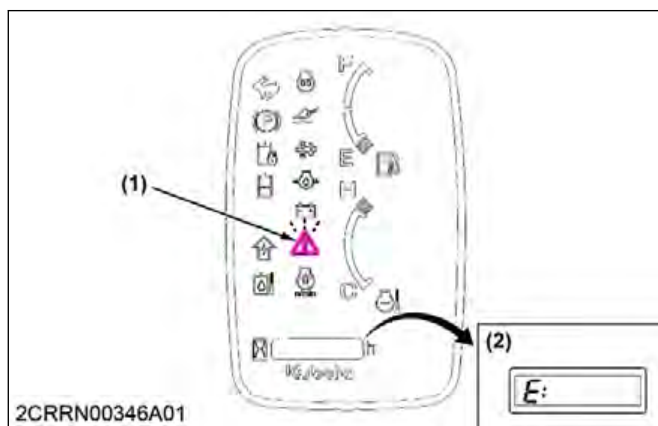
Normal	Conducting
--------	------------

2.15 Handling E:020 Anti-stall proportional solenoid error

Short circuit or broken harness has occurred in the anti-stall proportional solenoid line.

Checking on the meter panel

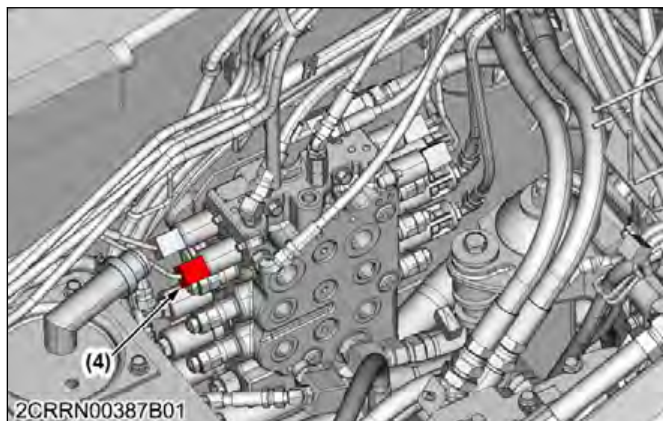
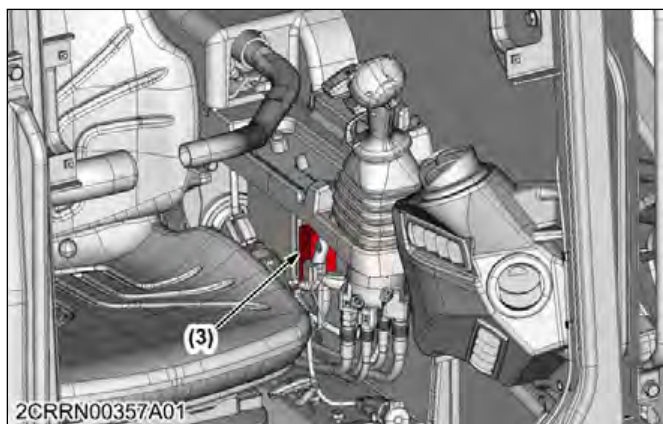
- Check the warning lamp and error code.



- (1) Warning lamp
(2) "E:020" Anti-stall proportional solenoid error

Checking devices

- Check the main ECU, anti-stall proportional solenoid, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

(4) Anti-stall proportional solenoid connector

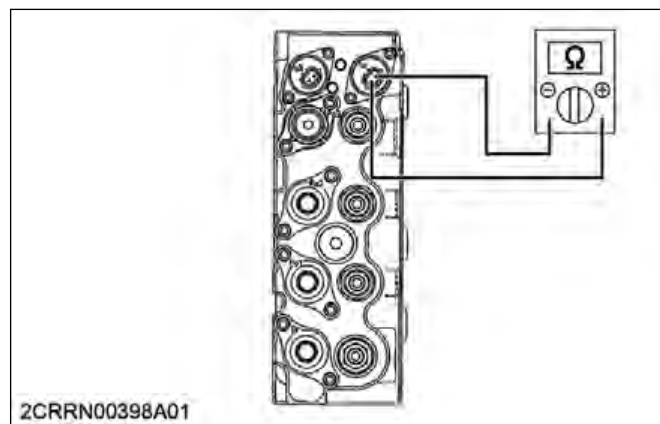


(5) Joint connector (main harness side)

(6) Joint connector (engine harness side)

2. Measure the resistance of the anti-stall proportional solenoid.

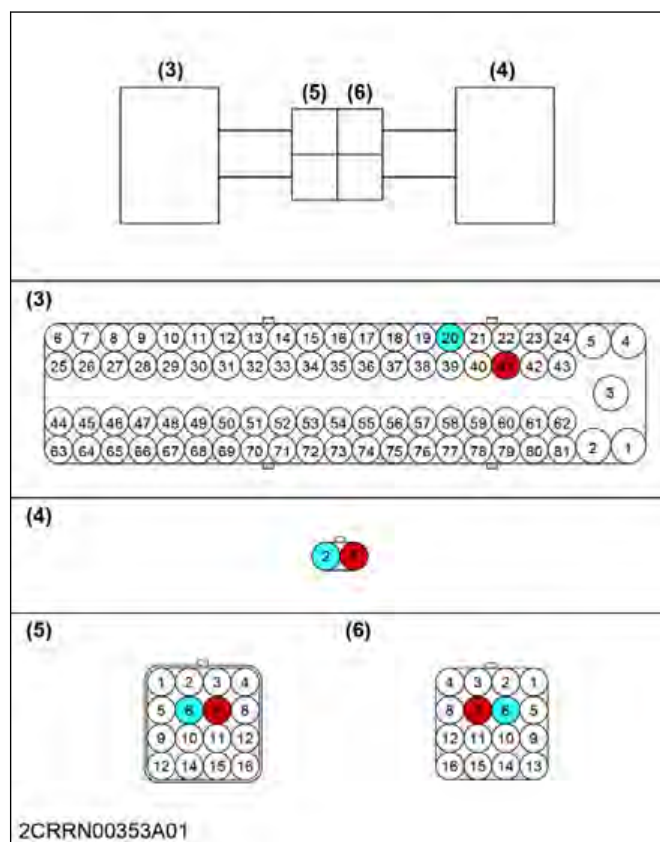
- Disconnect the anti-stall proportional solenoid connector.



Normal

Approximately 2.9 Ω

Checking the wire harness



(3) Main ECU connector

(4) Anti-stall proportional solenoid connector

(5) Joint connector (main harness side)

(6) Joint connector (engine harness side)

1. Measure the voltage of the wire harness.

- Disconnect the anti-stall proportional solenoid connector.

	(+)	(-)
(4) Anti-stall proportional solenoid connector	1	2

Normal	Hydraulic lock ON	Hydraulic lock OFF
	0 V	12 V

2. Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, anti-stall proportional solenoid connector, and joint connector.

	12 V	GND
(3) Main ECU connector	41	20
(4) Anti-stall proportional solenoid connector	1	2
(5) Joint connector (main harness side)	7	6
(6) Joint connector (engine harness side)	7	6

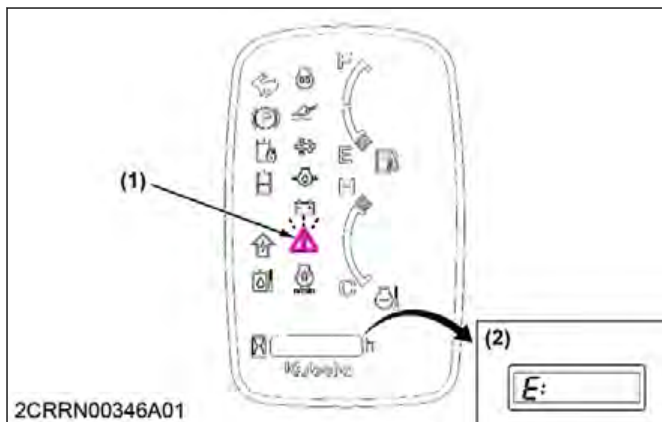
Normal	Conducting
--------	------------

2.16 Handling E:021 External 5 V error

External 5 V detection port detected high voltage (short circuit in the 5 V line).

Checking the meter panel

1. Check the warning lamp and error code.

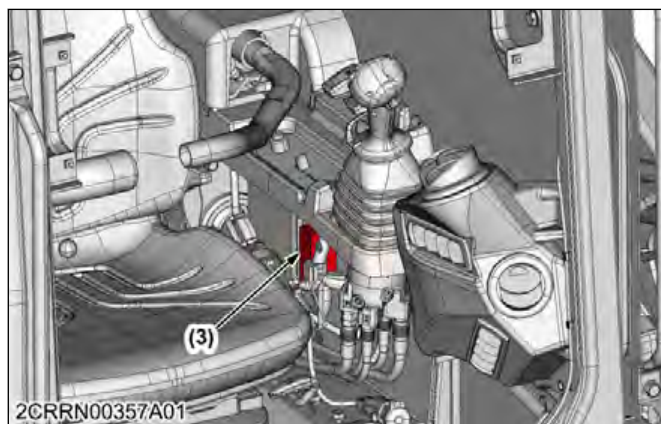


(1) Warning lamp

(2) "E:021" External 5 V error

Checking devices

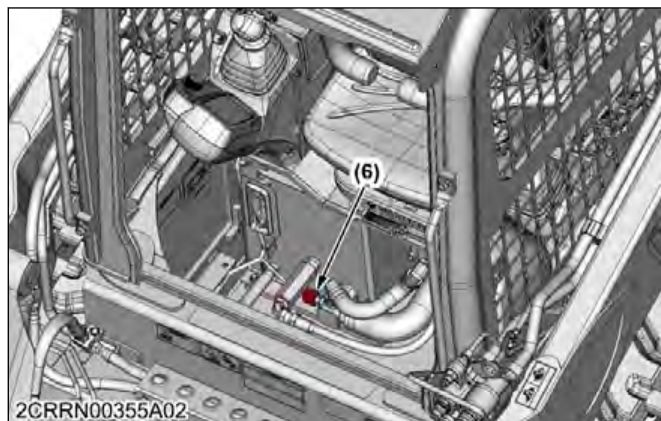
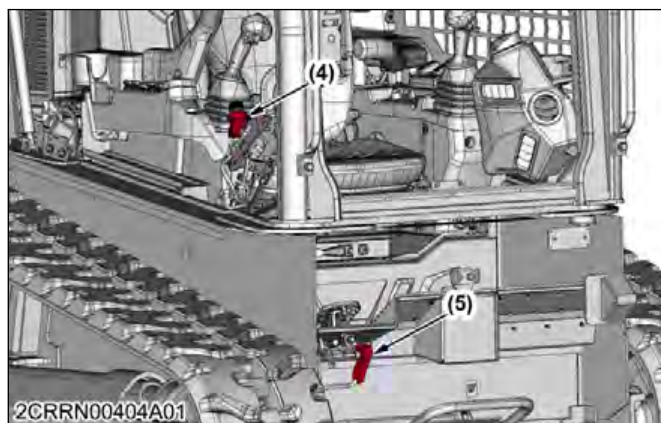
1. Check the main ECU.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

2. Check the accelerator pedal sensor, accelerator dial sensor, hydraulic oil temperature sensor, control lever RH, and joint connector.

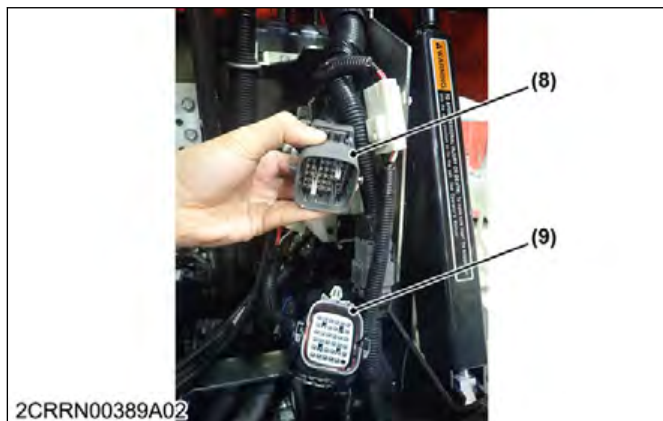
- Check the connectors for loose connection or poor contact.
- Disconnect and reconnect the connectors and check if the error is resolved.
- Check the cover of the wiring for damage and that they are not touching the body.



(4) Accelerator pedal sensor connector

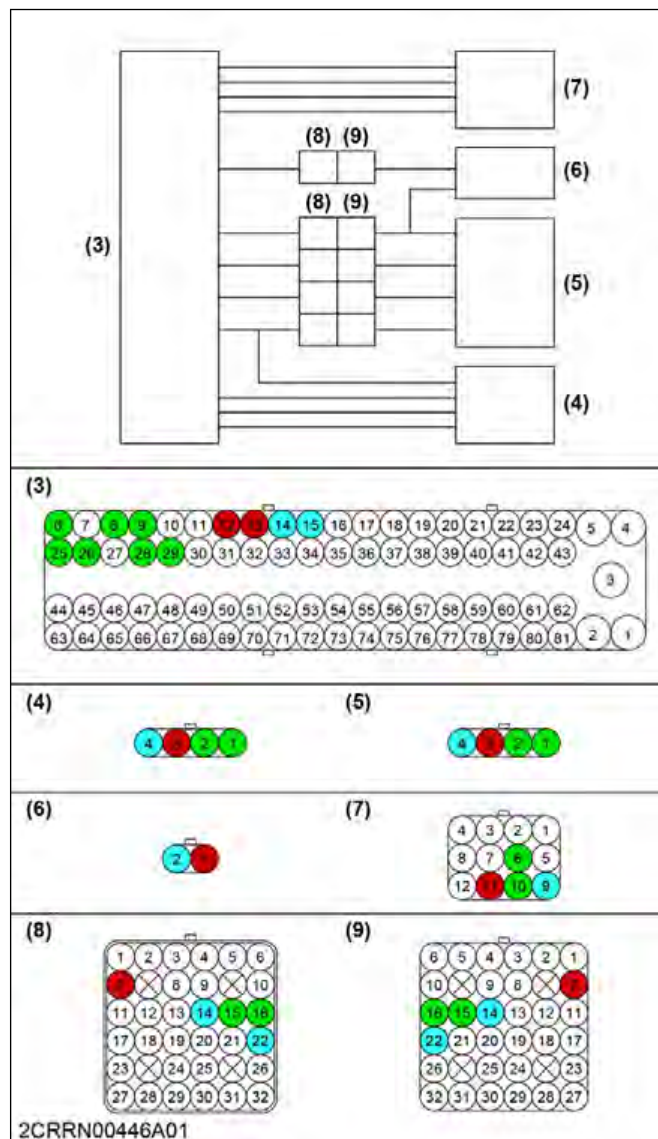
(6) Hydraulic oil temperature sensor connector

(5) Accelerator dial sensor connector



(7) Control lever RH connector (8) Joint connector (main harness side)
(9) Joint connector (engine harness side)

Checking the wire harness



(3) Main ECU connector (7) Control lever RH connector
(4) Accelerator pedal sensor connector (8) Joint connector (main harness side)
(5) Accelerator dial sensor connector (9) Joint connector (engine harness side)
(6) Hydraulic oil temperature sensor connector

1. Measure the voltage of the wire harness.
 - Disconnect each connector.

	(+)	(-)
(4) Accelerator pedal sensor connector	3	4
(5) Accelerator dial sensor connector	3	4
(6) Hydraulic oil temperature sensor connector	1	2
(7) Control lever RH connector	11	9

Normal	Starter switch at [STOP]	Starter switch at [RUN]
	0 V	5 V

2. Check the conduction of the wire harness.
 - Turn the starter switch to [STOP], and disconnect the connectors.

	5 V	Accelerator pedal sensor signal (main)	Accelerator pedal sensor signal (sub)
(3) Main ECU connector	12	8	28
(4) Accelerator pedal sensor connector	3	2	1
(8) Joint connector (main harness side)	7	15	16
(9) Joint connector (engine harness side)	7	15	16

	5 V	Accelerator dial sensor signal (main)	Accelerator pedal sensor signal (sub)
(3) Main ECU connector	12	29	9
(5) Accelerator dial sensor connector	3	2	1

	5 V	Hydraulic oil temperature sensor signal
(3) Main ECU connector	12	25
(6) Hydraulic oil temperature sensor connector	1	2
(8) Joint connector (main harness side)	7	22
(9) Joint connector (engine harness side)	7	22

	5 V	Control lever RH signal (main)	Control lever RH signal (sub)
(3) Main ECU connector	13	6	26
(7) Control lever RH connector	11	10	6

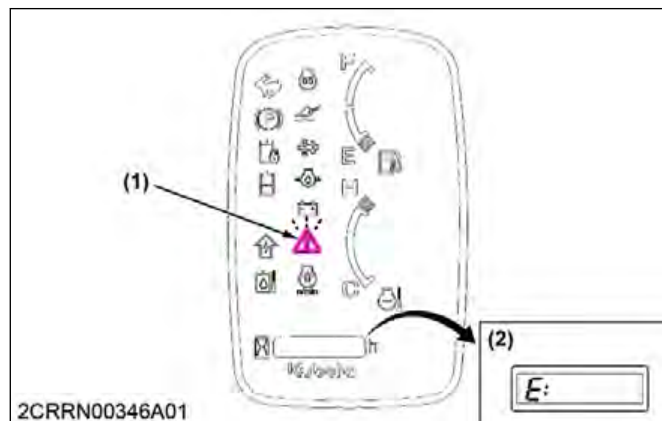
Normal	Conducting
--------	------------

2.17 Handling E:023 Battery overcharged

Power supply voltage is over 18 V.

Checking on the meter panel

1. Check the warning lamp and error code.



(1) Warning lamp

(2) "E:023" Battery overcharged

Checking devices

1. Check the battery.
 - Check that a battery with a rated output exceeding 12 V is not used.
2. Check the battery voltage in the tester mode.

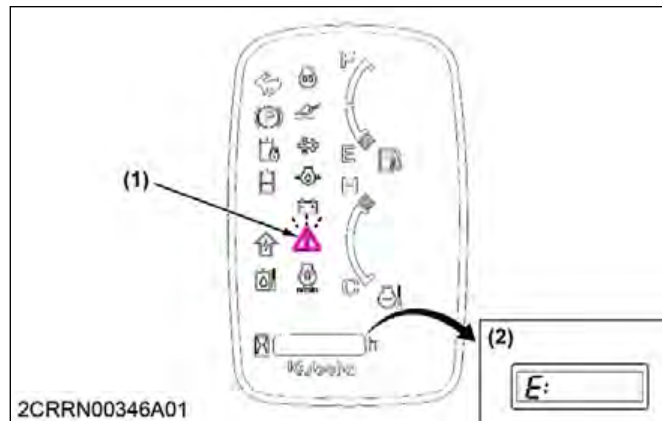
"no-01" Tester mode	"2: ∞.0 V"	Engine stopped	Engine running
		12 V	Approximately 14 V

2.18 Handling E:024 Hydraulic oil temperature sensor error

Short circuit or broken harness has occurred in the hydraulic oil temperature sensor line.

Checking on the meter panel

1. Check the warning lamp and error code.

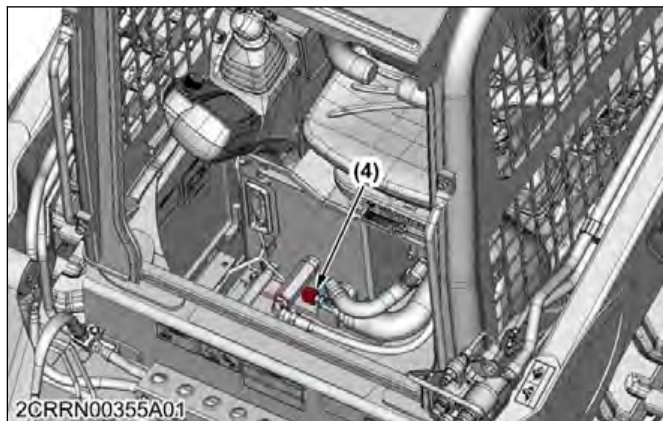
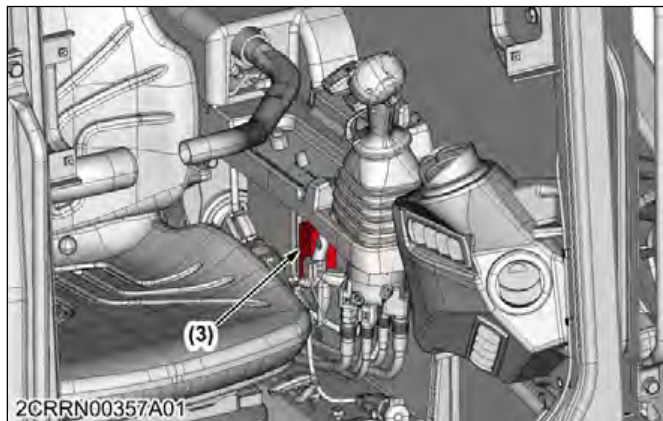


(1) Warning lamp

(2) "E:024" Hydraulic oil temperature sensor error

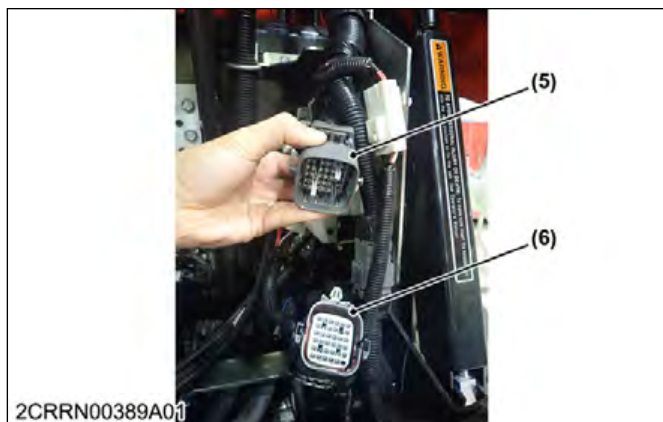
Checking the devices

1. Check the main ECU, hydraulic oil temperature sensor, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

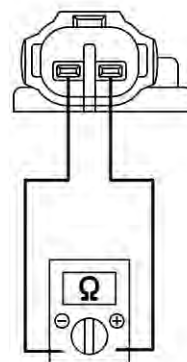
(4) Hydraulic oil temperature sensor



(5) Joint connector (main harness side)

(6) Joint connector (engine harness side)

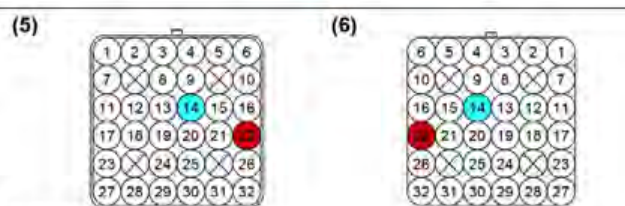
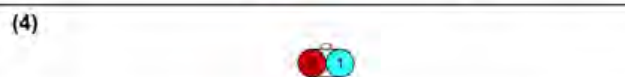
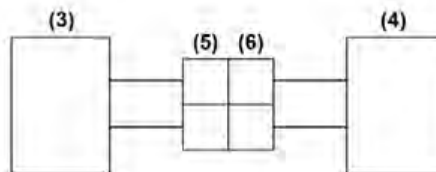
2. Measure the resistance of the hydraulic oil temperature sensor.
 - Disconnect the hydraulic oil temperature sensor connector.



2CRRN00399A01

Normal

11 to 13 Ω

Checking the wire harness

2CRRN00354A01

- (3) Main ECU connector
- (4) Hydraulic oil temperature sensor connector
- (5) Joint connector (main harness side)
- (6) Joint connector (engine harness side)

1. Measure the voltage of the wire harness.
 - Disconnect the hydraulic oil temperature sensor connector, and turn the starter switch to **[RUN]**.

	(+)	(-)
(4) Hydraulic oil temperature sensor connector	2	1

Normal	Starter switch [STOP]	Starter switch [RUN]
	0 V	5 V

2. Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, hydraulic oil temperature sensor connector, and joint connector.

	12 V	GND
(3) Main ECU connector	25	14
(4) Hydraulic oil temperature sensor connector	2	1
(5) Joint connector (main harness side)	22	14
(6) Joint connector (engine harness side)	22	14

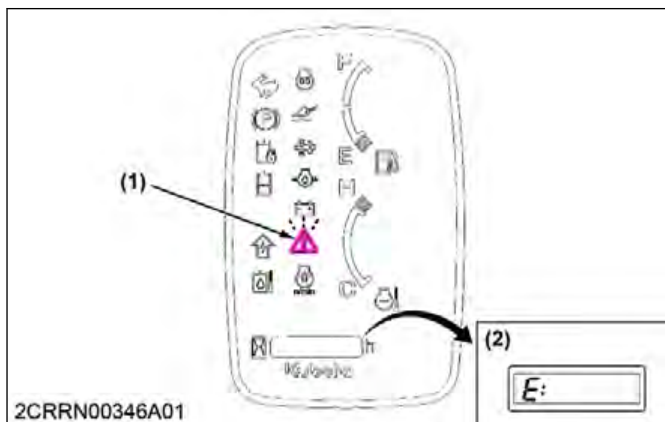
Normal	Conducting
--------	------------

2.19 Handling E:026CRSCAN communication error

There is no communication between the main ECU and engine ECU.

Checking the meter panel

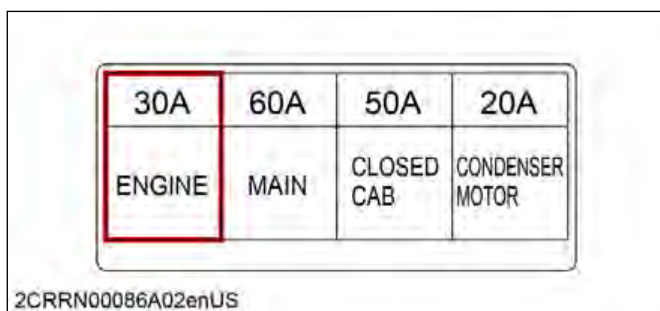
1. Check the warning lamp and error code.



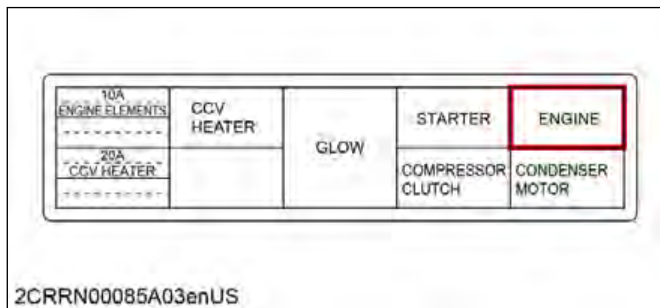
- (1) Warning lamp
- (2) "E:026" CRS CAN communication error

Checking devices

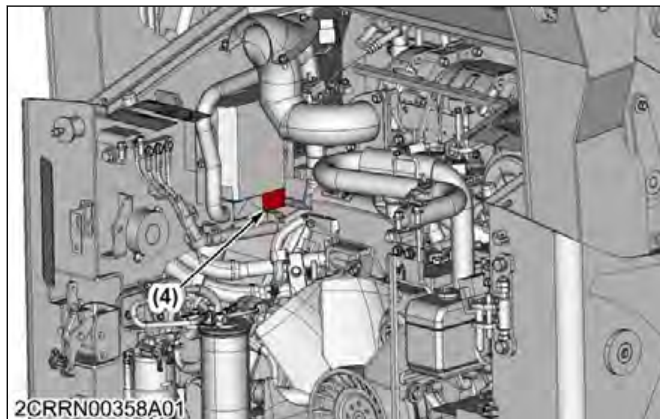
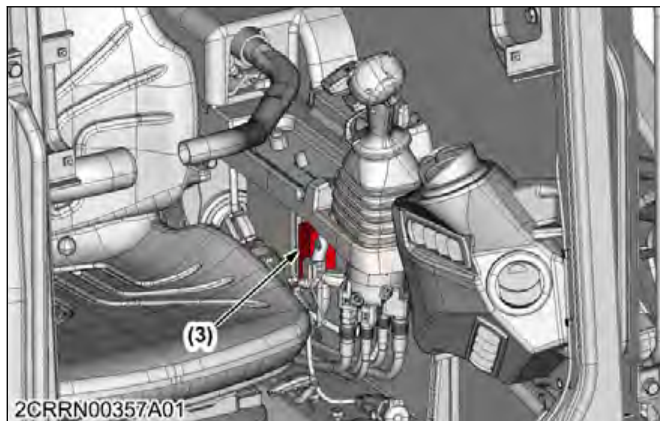
1. Check the slow blow fuse (**[ENGINE]**) 30 A.



2. Check the relay (**[ENGINE]**).



3. Check the main ECU connector, engine ECU connector, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.

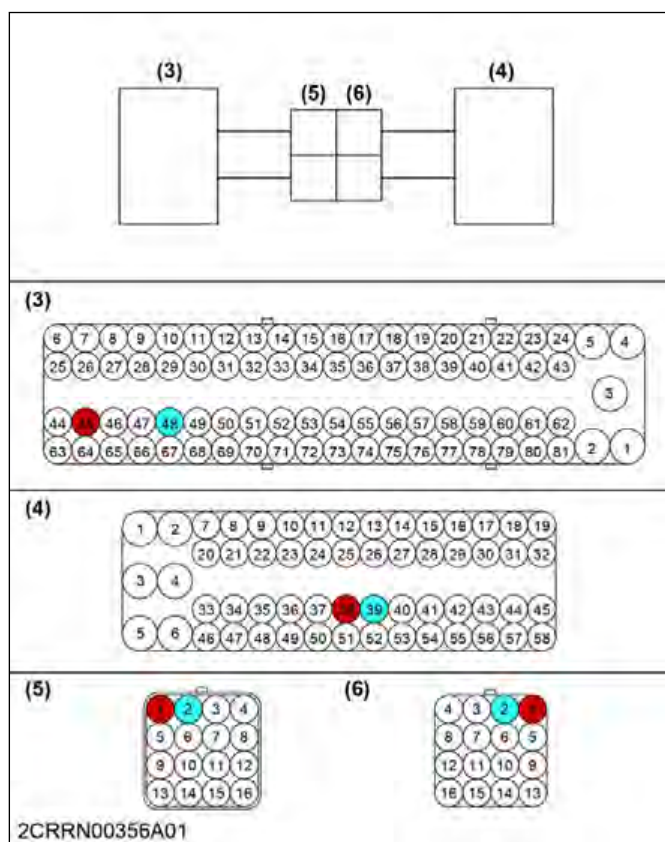


- (3) Main ECU connector
- (4) Engine ECU connector



(5) Joint connector (main harness side) (6) Joint connector (engine harness side)

Checking the wire harness



(3) Main ECU connector (4) Engine ECU connector
(5) Joint connector (main harness side) (6) Joint connector (engine harness side)

- Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector and meter panel connector.

	CAN-HIGH	CAN-LOW
(3) Main ECU connector	45	48
(4) Engine ECU connector	38	39
(5) Joint connector (main harness side)	1	2
(6) Joint connector (engine harness side)	1	2

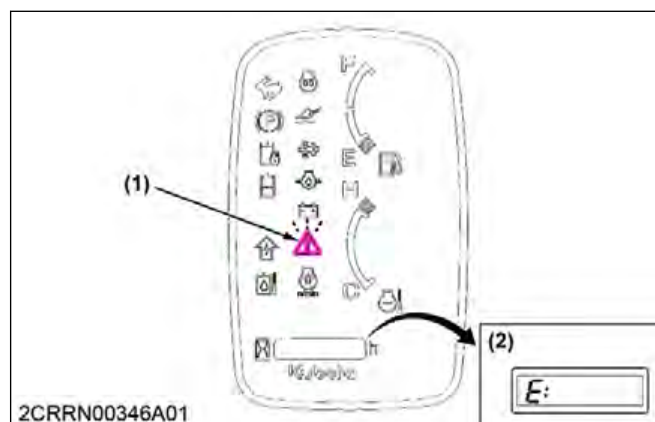
Normal	Conducting
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2.20 Handling E:028 Accelerator pedal sensor error

Short circuit or broken harness has occurred in the accelerator pedal sensor line.

Checking the meter panel

- Check the warning lamp and error code.



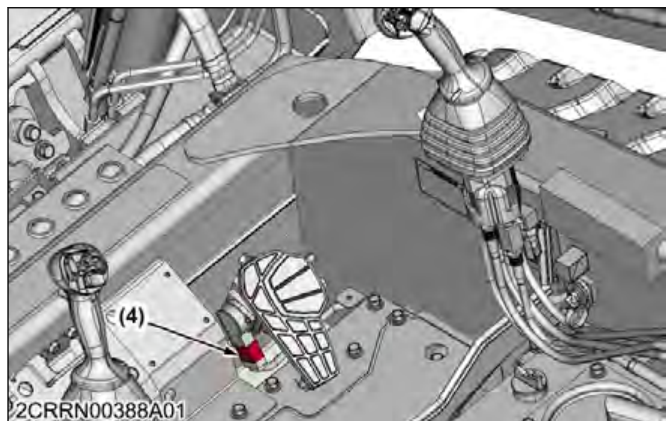
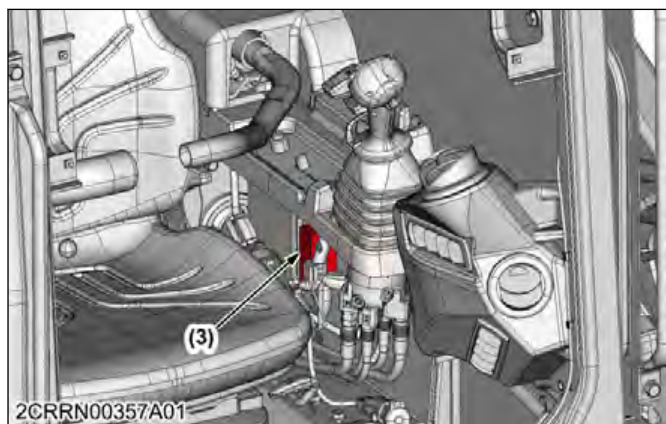
(1) Warning lamp (2) "E:028" Accelerator pedal sensor error

- Check the accelerator dial sensor voltage in the tester mode.

"no-01" Tester mode	"9: 0.00 V" Accelerator pedal sensor voltage (main)	0.26 to 4.74 V
	"10: 0.00 V" Accelerator pedal sensor voltage (sub)	0.26 to 4.74 V

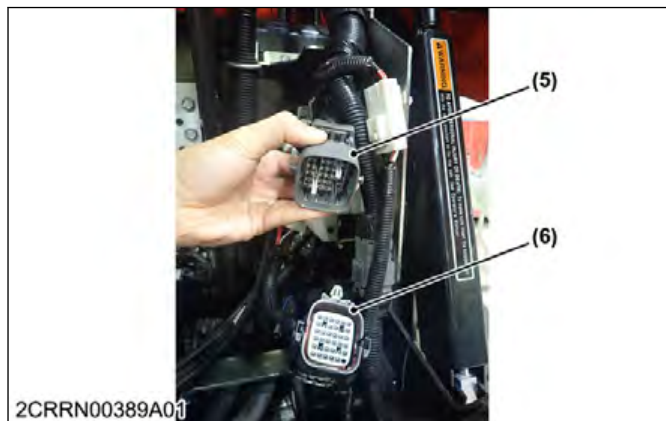
Checking the devices

- Check the main ECU, accelerator pedal sensor, and joint connector.
 - Check the connectors for loose connection or poor contact.
 - Disconnect and reconnect the connectors and check if the error is resolved.
 - Check the cover of the wiring for damage and that they are not touching the body.



(3) Main ECU connector

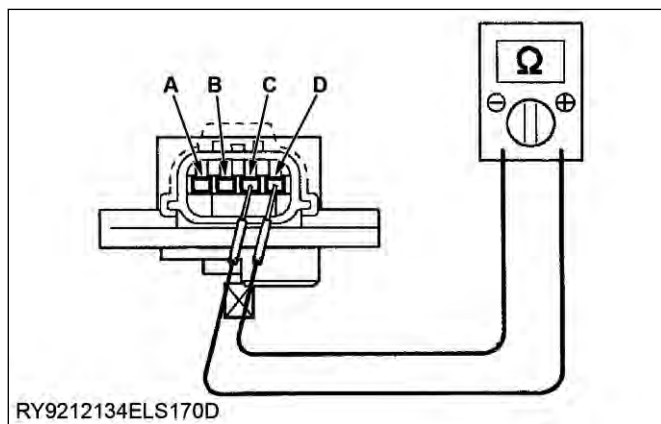
(4) Accelerator pedal sensor connector



(5) Joint connector (main harness side)

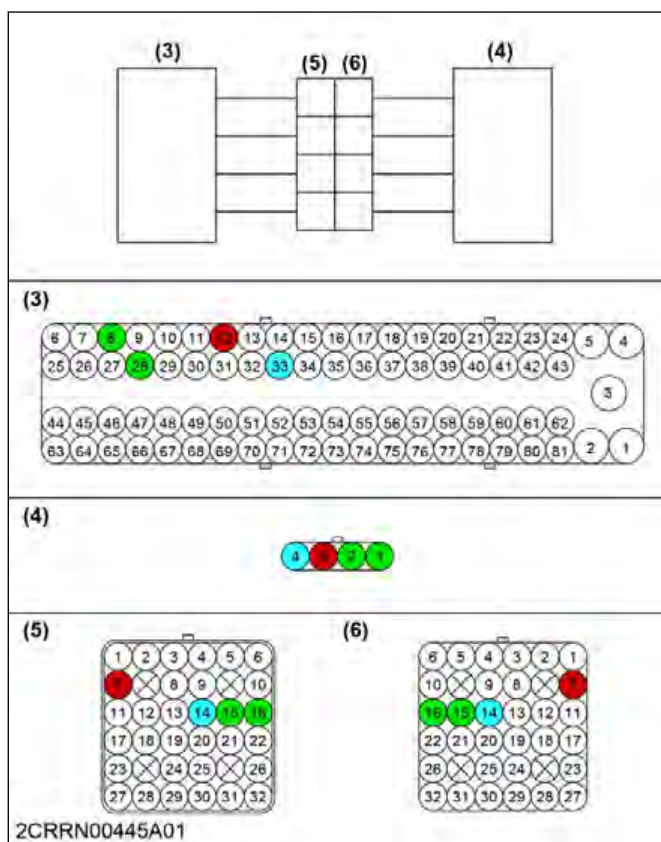
(6) Joint connector (engine harness side)

2. Measure the resistance of the accelerator pedal sensor between the terminal C and D.
 - Disconnect the accelerator pedal sensor connector.



Normal	0.8 to 1.2 kΩ
--------	---------------

Checking the wire harness



(3) Main ECU connector

(4) Accelerator pedal sensor connector

(5) Joint connector (main harness side)

(6) Joint connector (engine harness side)

1. Measure the voltage of the wire harness.
 - Disconnect the accelerator pedal sensor connector.

	(+)	(-)
(4) Accelerator pedal sensor connector	3	4

Normal	Starter switch at [OFF]	Starter switch at [RUN]
	0 V	5 V

2. Check the conduction of the wire harness.

- Turn the starter switch to **[STOP]**, and disconnect the main ECU connector and accelerator pedal sensor connector.

	5 V	GND	Main out-put	Sub out-put
(3) Main ECU connector	12	14	28	8
(4) Accelerator pedal sensor connector	3	4	2	1
(5) Joint connector (main harness side)	7	14	15	16
(6) Joint connector (engine harness side)	7	14	15	16

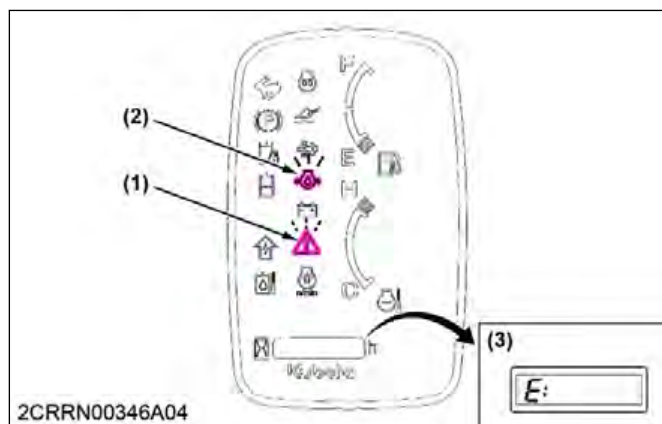
Normal	Conducting
--------	------------

2.21 Handling E:9118 Engine oil pressure error

The engine oil pressure switch is ON when the engine is running.

Checking the meter panel

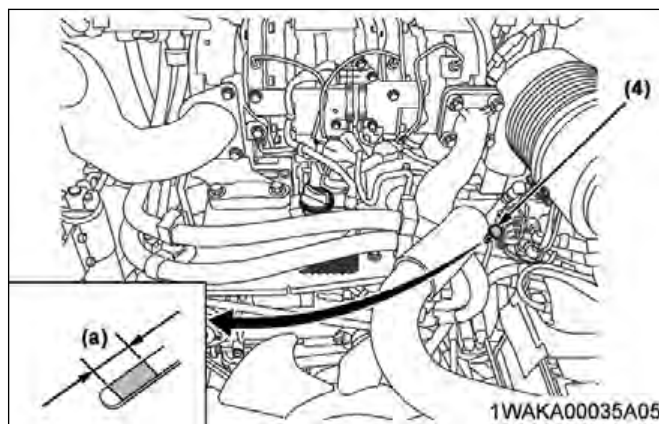
1. Check the warning lamp and error code.



- (1) Warning lamp
(2) Engine oil pressure warning lamp
(3) "E:9118" Engine oil pressure error

Checking the devices

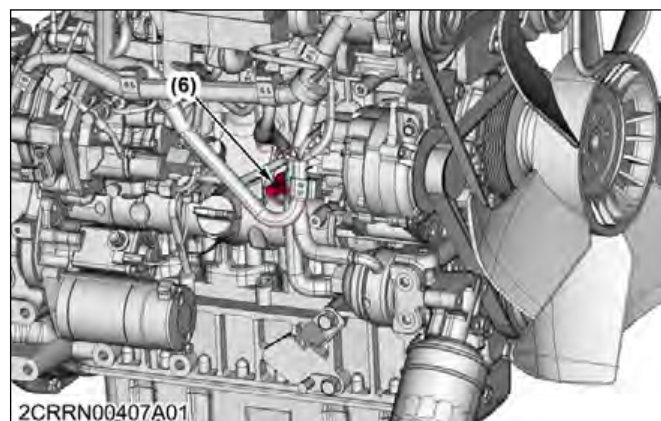
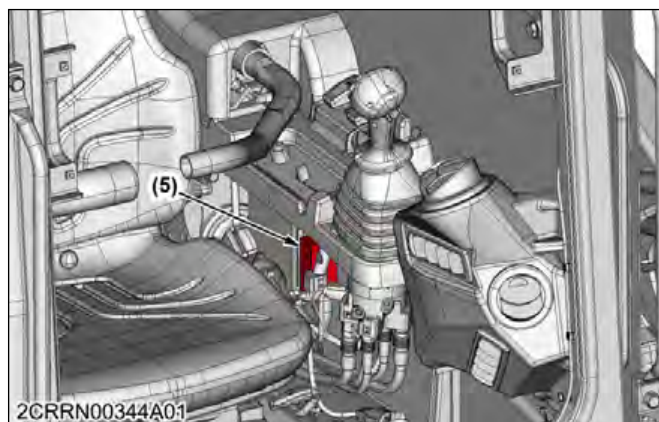
1. Check the engine oil level and replenish if necessary.



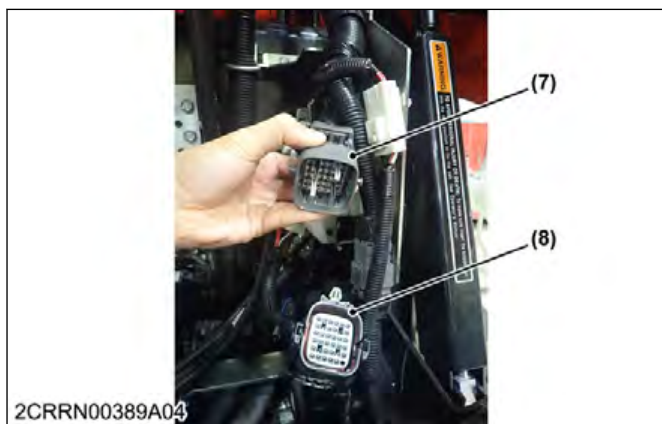
- (4) Dipstick (a) Proper engine oil level range

2. Check the main ECU, engine oil pressure switch, and joint connector.

- Check the connectors for loose connection or poor contact.
- Disconnect and reconnect the connectors and check if the error is resolved.
- Check the cover of the wiring for damage and that they are not touching the body.



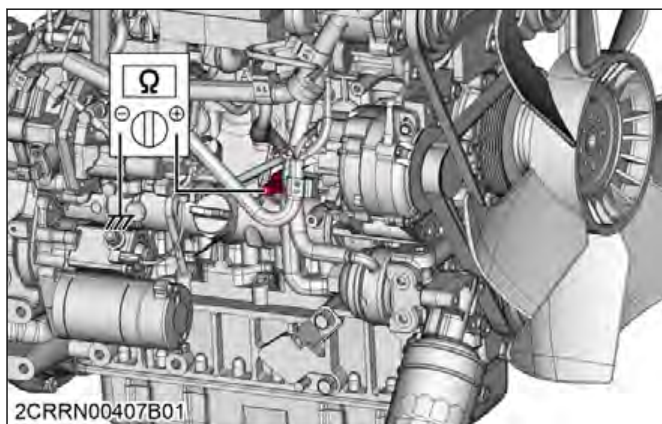
- (5) Main ECU connector (6) Engine oil pressure switch connector



(7) Joint connector (main harness side) (8) Joint connector (engine harness side)

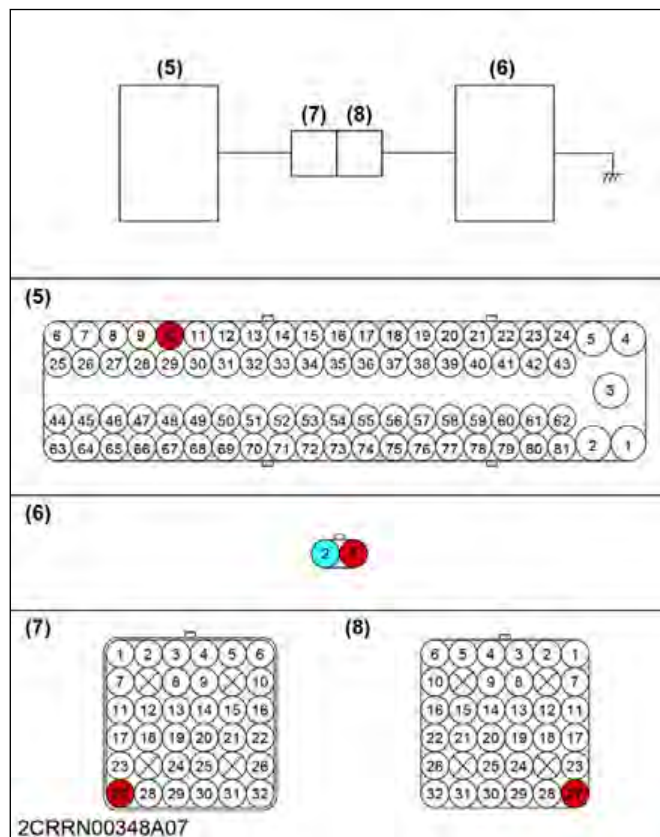
3. Measure the resistance of the engine oil pressure switch.

- Disconnect the engine oil pressure switch connector.
- Measure the resistance between the engine oil pressure switch terminal and body GND.



Normal	Engine stopped	Engine running
	Conducting	Not conducting

Checking the wire harness



(5) Main ECU connector (6) Engine oil pressure switch connector
(7) Joint connector (main harness side) (8) Joint connector (engine harness side)

1. Measure the voltage of the wire harness.

- Disconnect the engine oil pressure switch connector.

	(+)	(-)
(6) Engine oil pressure switch connector	1	2

Normal	Starter switch [STOP]	Starter switch [RUN]
	0 V	12 V

2. Check the conduction of the wire harness.

- Turn the starter switch to [STOP], and disconnect the main ECU connector, engine oil pressure switch connector, and joint connector.

	12 V	GND
(5) Main ECU connector	10	—
(6) Engine oil pressure switch connector	1	2
(7) Joint connector (main harness side)	27	—
(8) Joint connector (engine harness side)	27	—

Normal	Conducting
--------	------------

Measuring the engine oil pressure

1. Measure the engine oil pressure at the maximum engine speed.

**NOTE**

- The oil pressure switch turns on when the pressure is less than 49 kPa.

Service specifications

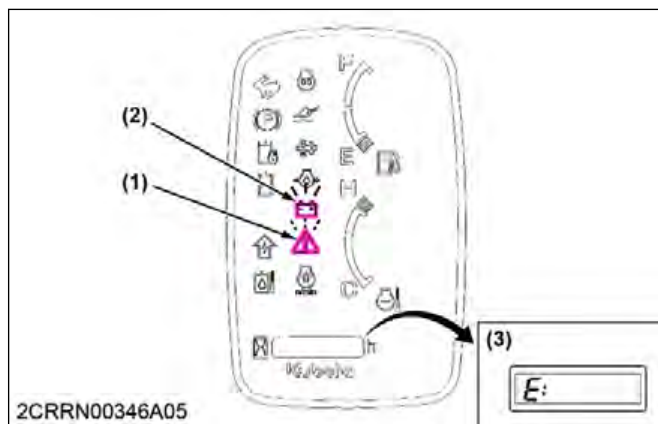
Engine oil pressure	MAX speed	245 to 441 kPa 2.5 to 4.5 kgf/cm ² 36 to 64 psi
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2.22 Handling E:9119 Battery charging error

The charge signal from the alternator is not detected by the main ECU when the engine is running.

Checking the meter panel

1. Check the warning lamp and error code.



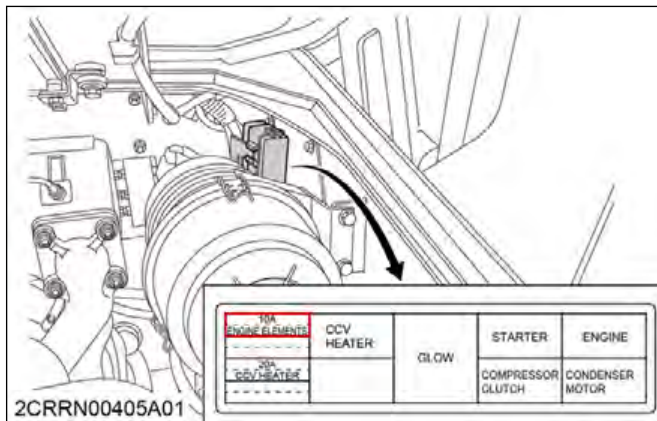
- (1) Warning lamp
(2) Charge warning lamp
(3) "E:9119" Battery charging error

2. Check the battery charge switch in the tester mode.

"no-01" Tester mode	"4:000.0 °C" "ON" or "OFF"	Engine stopped	Engine running
		"OFF"	"ON"

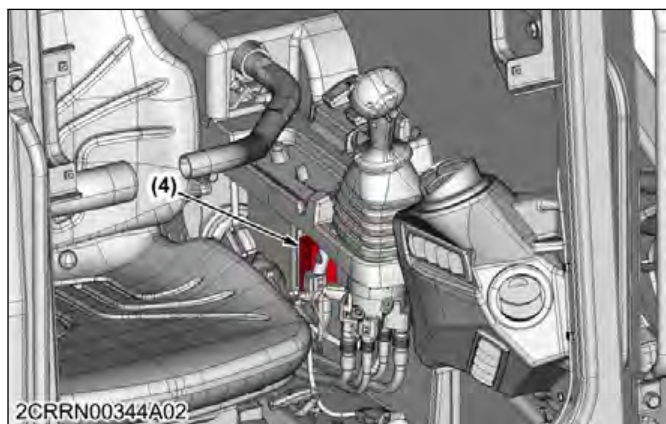
Checking the devices

1. Check the fuse ([ENGINE ELEMENTS]) 10 A.

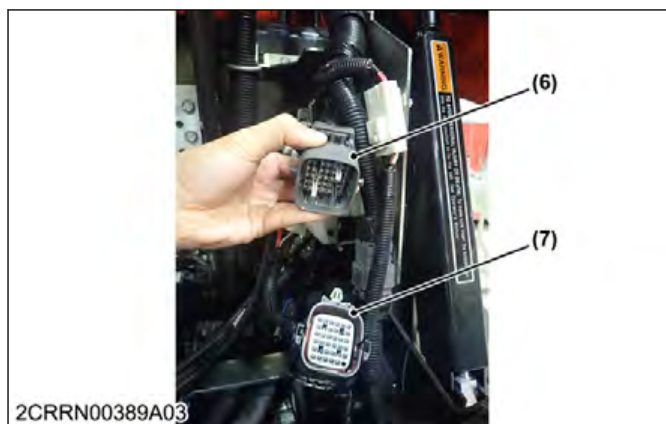


2. Check the main ECU, alternator, and joint connector.

- Check the connectors for loose connection or poor contact.
- Disconnect and reconnect the connectors and check if the error is resolved.
- Check the cover of the wiring for damage and that they are not touching the body.

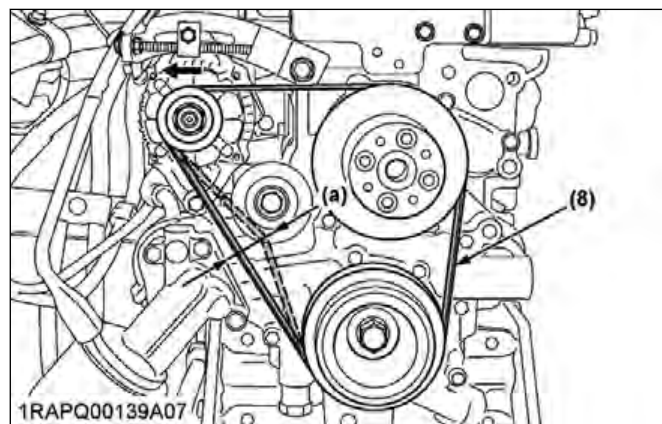


(4) Main ECU connector (5) Alternator connector



(6) Joint connector (main harness side) (7) Joint connector (engine harness side)

3. Check the fan belt.
 - Check the tension, damage and slippage.

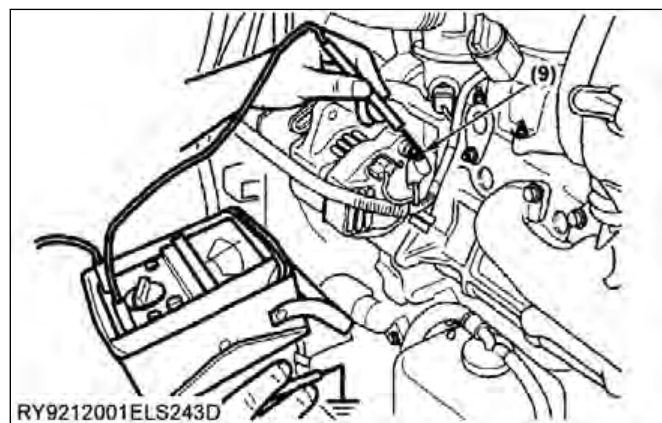


(8) Fan belt

Service specifications

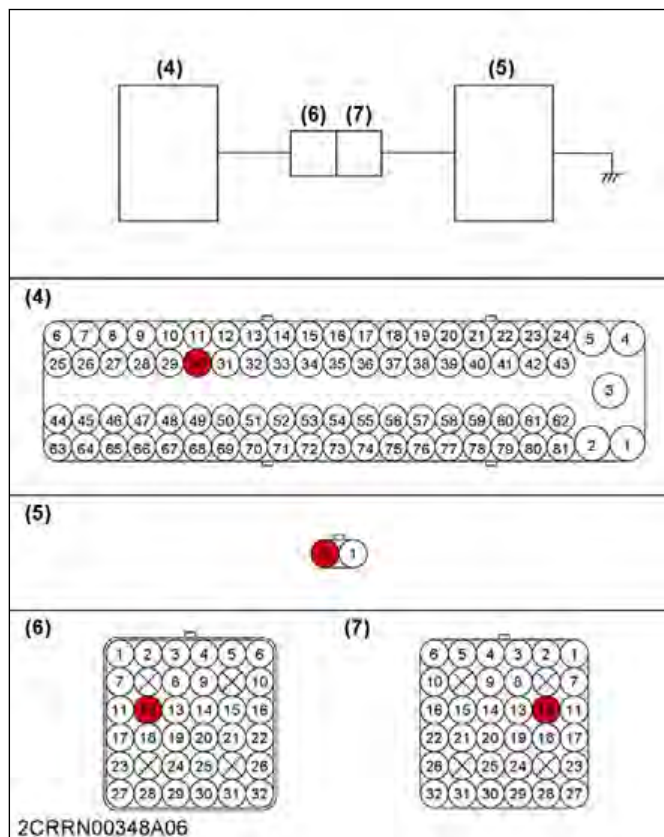
(a) Fan belt tension	4.0 to 5.0 mm 0.16 to 0.20 in.	Push with 50 to 60 N Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf
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4. Measure the voltage of the alternator.
 - Measure the voltage between the terminal B of the alternator and the body GND.



(9) Terminal B

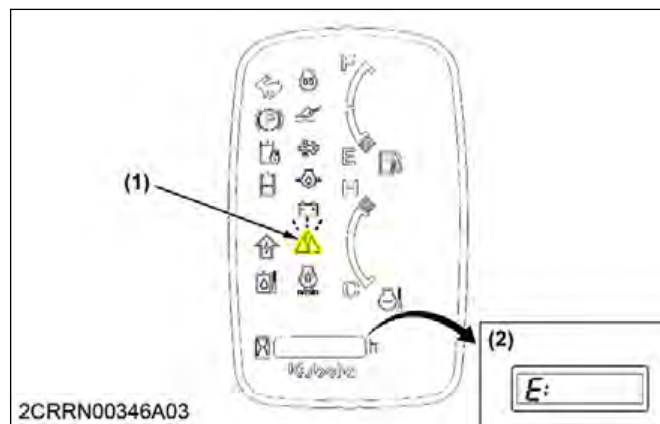
Normal	Engine stopped	Engine running
	12 V	Approximately 14 V

Checking the wire harness

- (4) Main ECU connector
(5) Alternator connector
(6) Joint connector (main harness side)
(7) Joint connector (engine harness side)

- Check the conduction of the wire harness.
 - Turn the starter switch to **[STOP]**, and disconnect the main ECU connector, alternator connector, and joint connector.

	Charge signal
(4) Main ECU connector	30
(5) Alternator connector	2
(6) Joint connector (main harness side)	12
(7) Joint connector (engine harness side)	12
Normal	Conducting



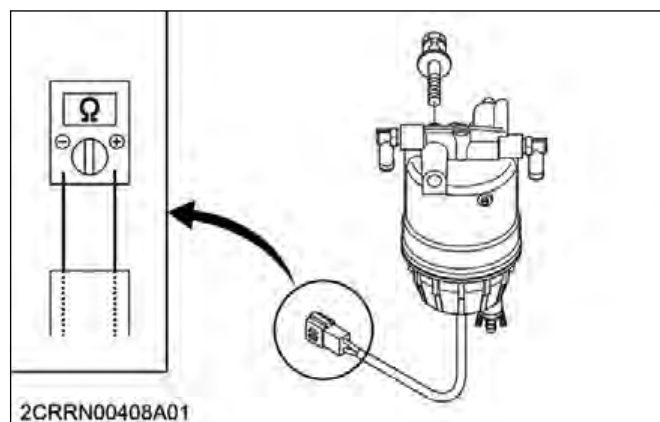
- (1) Warning lamp
(2) "E:9120" Water separator error

Checking the devices

- Drain the water from the water separator.

Checking the wire harness

- Check the conduction of the wire harness.
 - Disconnect the connector of the water separator level sensor.



Water level	Full	Empty
Normal	Conducting	Not conducting

2.23 Handling E:9120 Water separator error

Water separator is full with water.

Checking on the meter panel

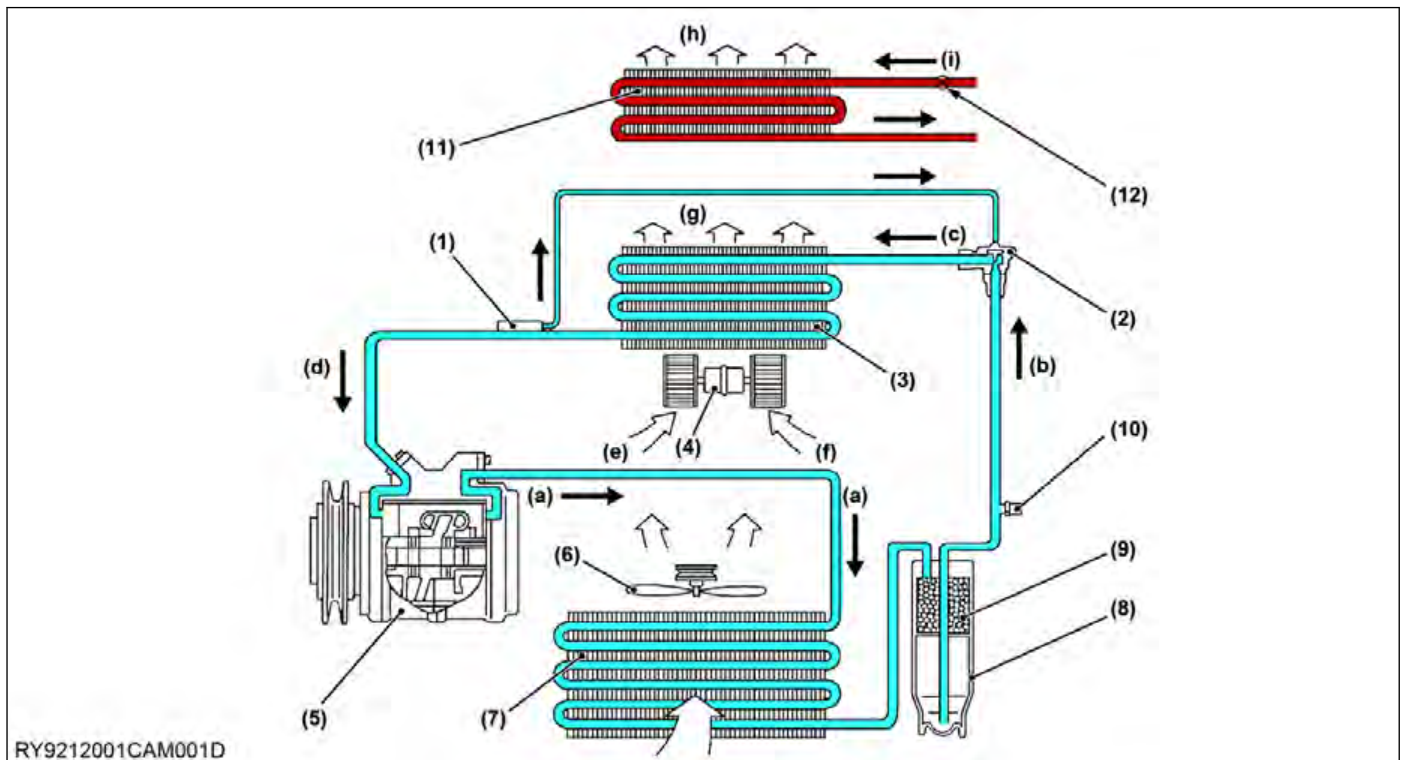
- Check the warning lamp and error code.

8. AIR CONDITIONING AND HEATER SYSTEM

MECHANISM

1. Air conditioning and heater system general description

The air conditioning unit supplies cool air with the cooling cycle and also supplies hot air with the heating cycle.



- | | | | |
|---------------------|----------------------|--|--|
| (1) Capillary tube | (7) Condenser | (a) High temperature and pressure gas refrigerant | (d) Low temperature and pressure gas refrigerant |
| (2) Expansion valve | (8) Receiver | (b) Liquid refrigerant | (e) Cabin air |
| (3) Evaporator | (9) Dryer | (c) Low temperature and pressure vapor refrigerant | (f) Ambient inlet air |
| (4) Blower | (10) Pressure switch | | (g) Cooled air |
| (5) Compressor | (11) Heater core | | (h) Hot air |
| (6) Condenser fan | (12) Heater valve | | (i) Coolant |

Cooling cycle

- The compressor compresses the refrigerant and discharges it into the condenser.
- The condenser cools down and liquefies the discharged refrigerant, and the refrigerant flows into the receiver.
- The receiver filters water, contamination, and air from the liquid refrigerant and the refrigerant flows into the expansion valve.
- The expansion valve sprays the optimal volume of the refrigerant into the evaporator.
- The sprayed refrigerant turns into gas in the evaporator and takes evaporation heat from the cabin and ambient inlet air.
- The gas refrigerant returns to the compressor.

Heating cycle

- The heated coolant flows into the heater core through the heater valve, and heats up the cabin and ambient inlet air by the heat convection.
- The heater valve controls the flow rate of the heated coolant. The air temperature increases as the flow rate increases.
- The coolant returns to the engine.

8. AIR CONDITIONING AND HEATER SYSTEM

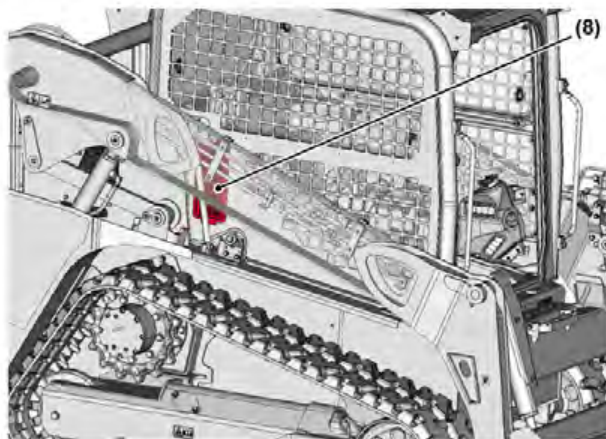
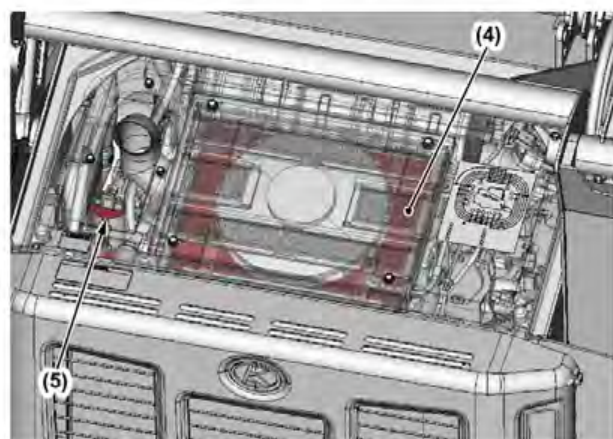
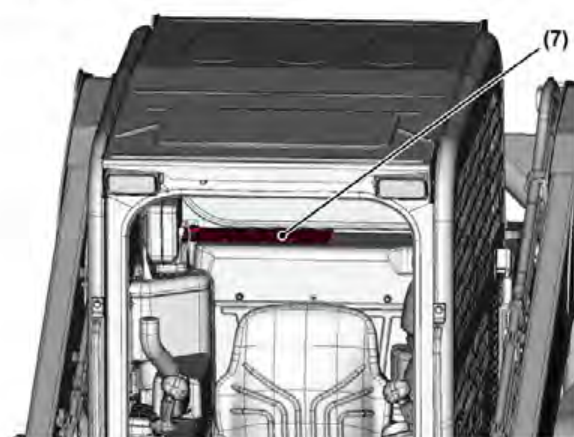
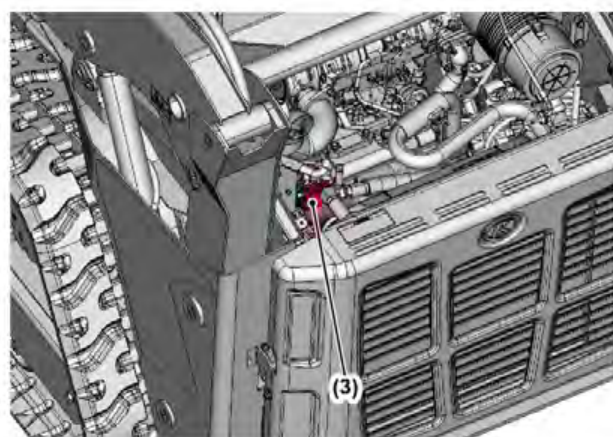
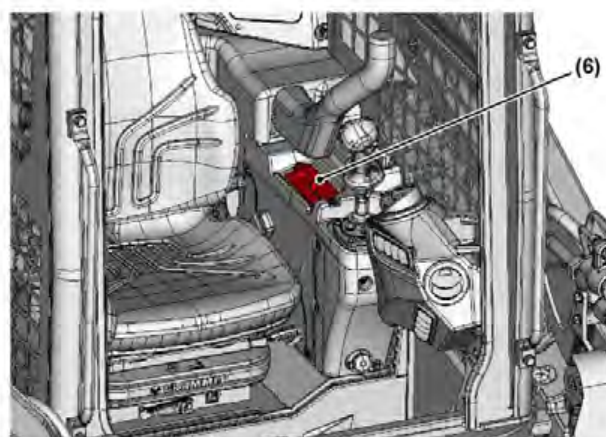
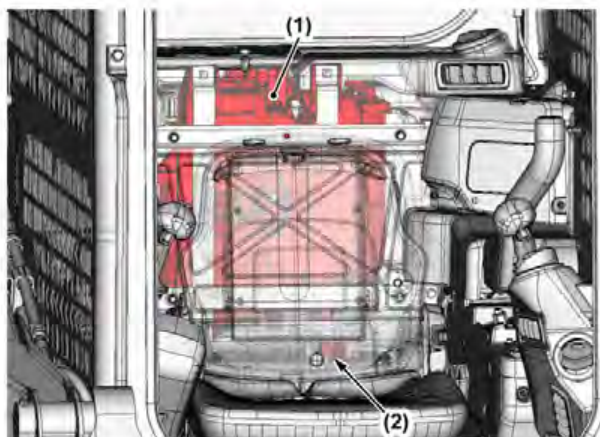
Air conditioning system

- The air conditioning unit supplies the optimal cool air with the combination of the cooling cycle and heater cycle.

Heater system

- The air conditioning unit supplies the optimal hot air with the heater cycle.

2. Air conditioning device layout



2CRRN00103A01

(1) Air conditioning unit
(2) Pressure switch

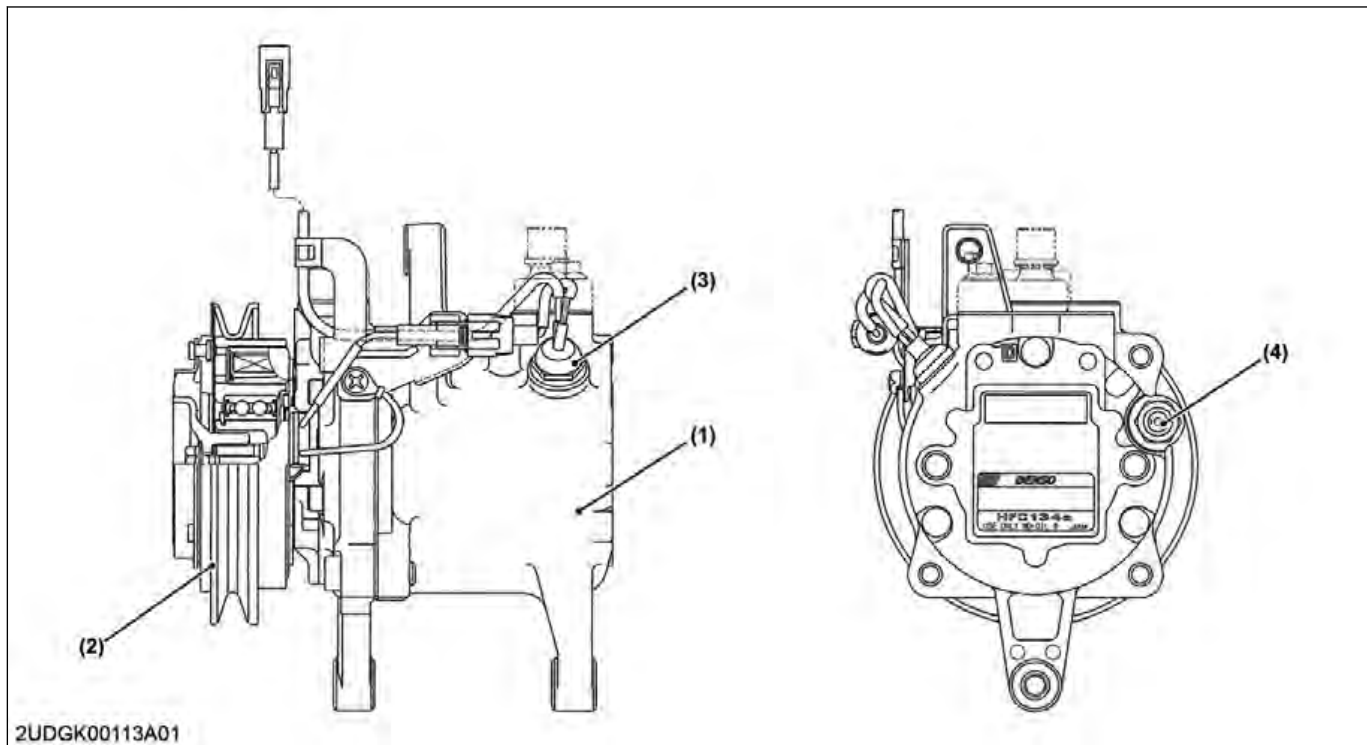
(3) Compressor
(4) Condenser

(5) Receiver
(6) Control panel

(7) Cab air inlet
(8) Ambient air inlet

3. Compressor

3.1 Compressor specifications



(1) Compressor

(2) Magnetic clutch pulley

(3) Temperature switch

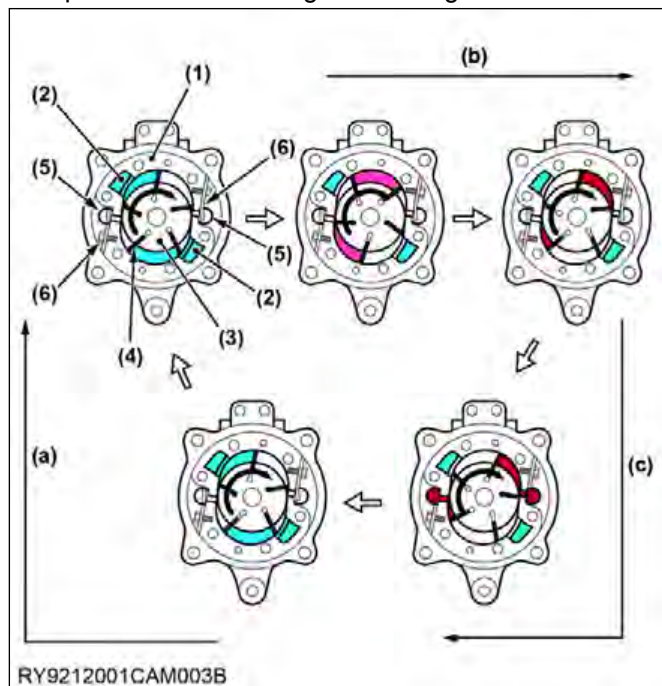
(4) Safety valve

		Specification
Compressor	Model	SV07E
	Discharging volume	0.07 L 0.018 U.S.gals
	Maximum speed	6000 rpm
	Lubricant	ND-oil8
		110 cm ³ 6.7 in. ³
	Mass	1.78 kg 3.9 lbs
Magnetic clutch pulley	Model	K20
	Transmission torque	More than 22 N·m More than 2.2 kgf·m More than 16.2 lbf·ft
	Maximum speed	6000 rpm
	Pulley diameter	φ108 mm 4.3 in.
	Mass	1.1 kg 2.4 lbs
Safety valve	Releasing pressure	3.43 to 4.12 MPa 34.98 to 42.01 kgf/cm ² 497.5 to 597.6 psi
	Shutting pressure	2.75 MPa 28.0 kgf/cm ² 398.9 psi
Temperature switch	Turn-on temperature	115 to 125 °C 239 to 257 °F
	Turn-off temperature	153 to 163 °C 307 to 325 °F

3.2 Compressor function and structure

3.2.1 Compressor working principles

Compresses and discharges the refrigerant.

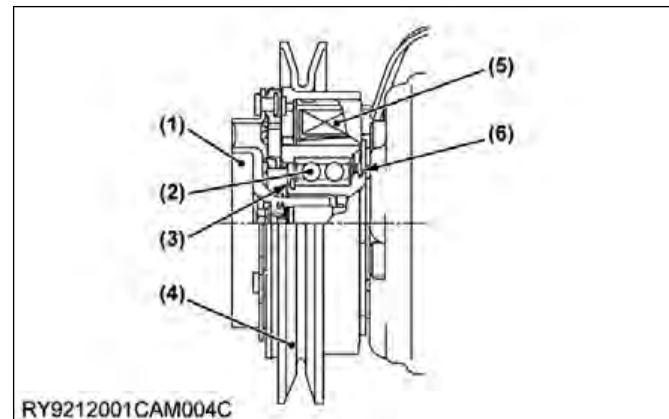


- | | |
|----------------------|-------------------------|
| (1) Housing | (6) Discharging valve |
| (2) Suction port | (a) Suction process |
| (3) Rotor | (b) Compression process |
| (4) Vane | (c) Discharging process |
| (5) Discharging port | |

- The gas refrigerant flows into the vane chamber.
- The rotor rotates, the vane chamber volume decreases, and the gas refrigerant is compressed.
- The compressed gas refrigerant opens the discharging valve and is discharged from the discharging port.

3.2.2 Magnetic clutch pulley

Engages the pulley and compressor shaft with an electromagnet clutch.

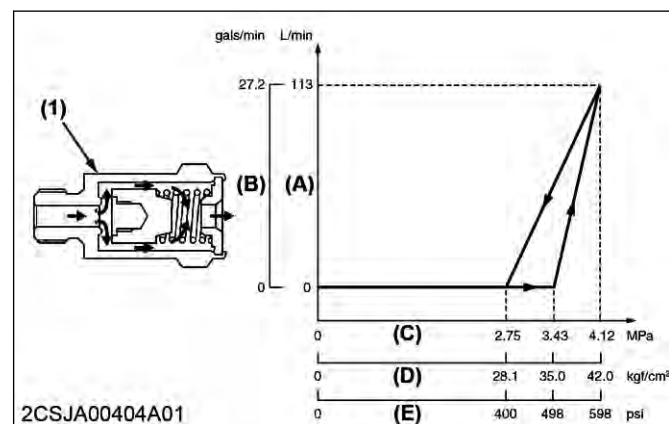


- | | |
|----------------------|----------------------|
| (1) Hub plate | (4) Pulley |
| (2) Ball bearing | (5) Stator |
| (3) External circlip | (6) External circlip |

- The magnetic clutch engages the pulley and compressor shaft when the pressure switch is turned on.
- The magnetic clutch disengages the pulley and the compressor shaft when the pressure switch is turned off.

3.2.3 Safety valve

Relieves the refrigerant to the atmosphere to protect the compressor in the case that the discharged refrigerant pressure is extremely high.

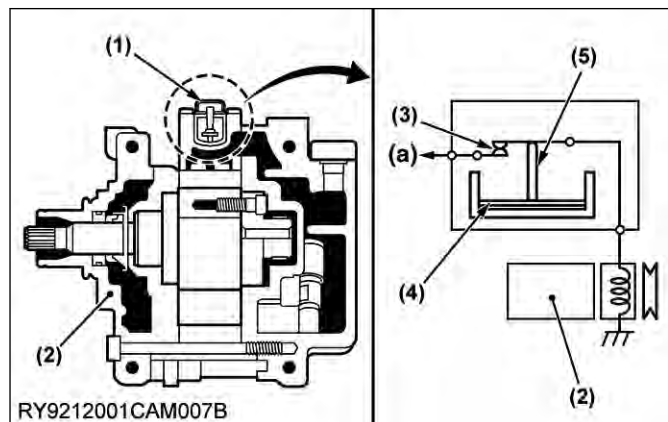


- | | |
|-------------------------------------|-------------------------------------|
| (1) Safety valve | (D) Discharged refrigerant pressure |
| (A) Relieved refrigerant volume | (E) Discharged refrigerant pressure |
| (B) Relieved refrigerant volume | |
| (C) Discharged refrigerant pressure | |

- The discharged refrigerant presses the poppet in the safety valve.
- The discharged refrigerant opens the poppet and flows out to the atmosphere in the case that the discharged refrigerant pressure is higher than the set pressure of the safety valve.

3.2.4 Temperature switch

Cuts off the current flow to the magnetic clutch to protect the compressor in the case that the discharged refrigerant temperature is extremely high.

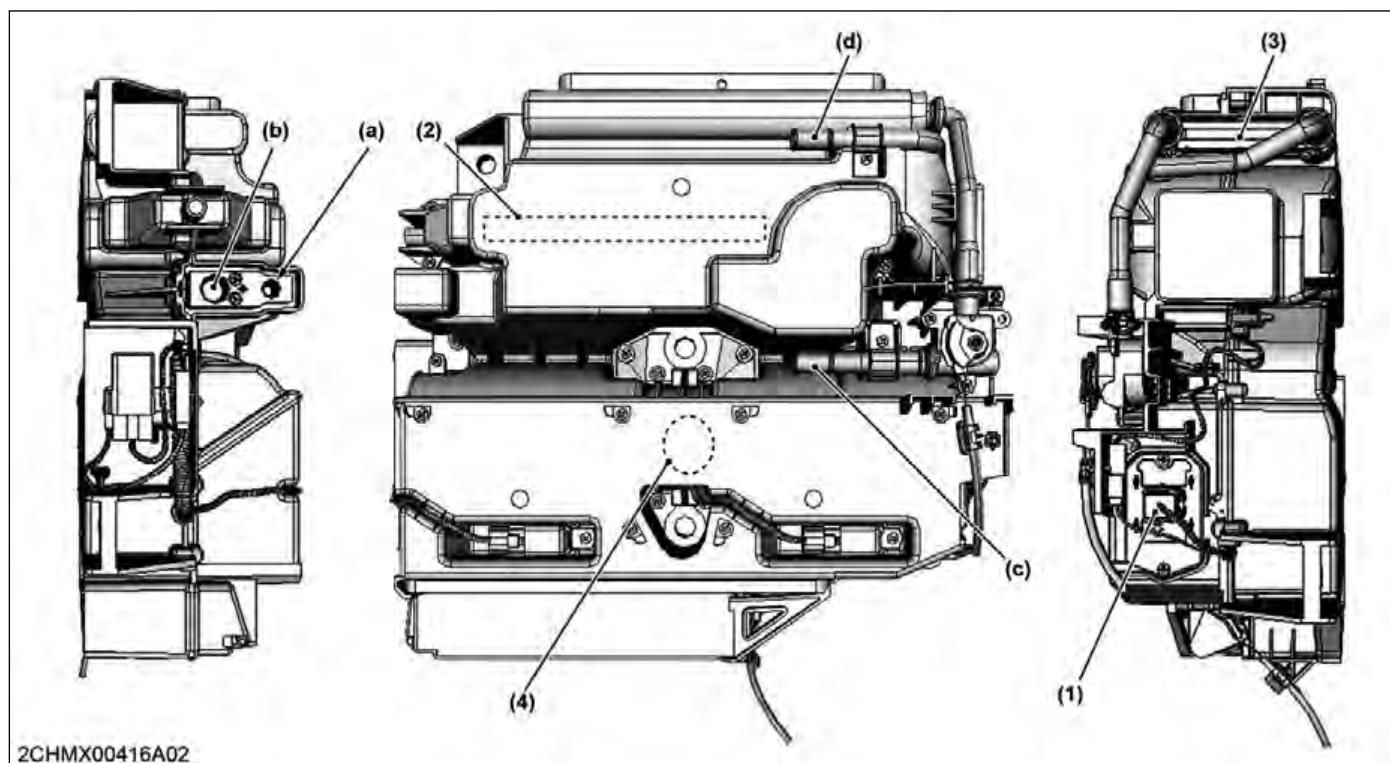


- | | |
|------------------------|----------------------|
| (1) Temperature switch | (4) Bimetallic strip |
| (2) Compressor | (5) Rod |
| (3) Switch | (a) From the relay |

- The discharged refrigerant heats the bimetallic strip in the temperature switch and the bimetallic strip deforms by the heat.
- The deformation of the bimetallic strip increases and presses the rod in the case that the refrigerant temperature increases extremely.
- The rod presses the switch and breaks the conduction.

4. Air conditioning unit

4.1 Air conditioning unit specifications



(1) Blower resistor
(2) Evaporator

(3) Heater core
(4) Blower motor

(a) Refrigerant inlet
(b) Refrigerant outlet

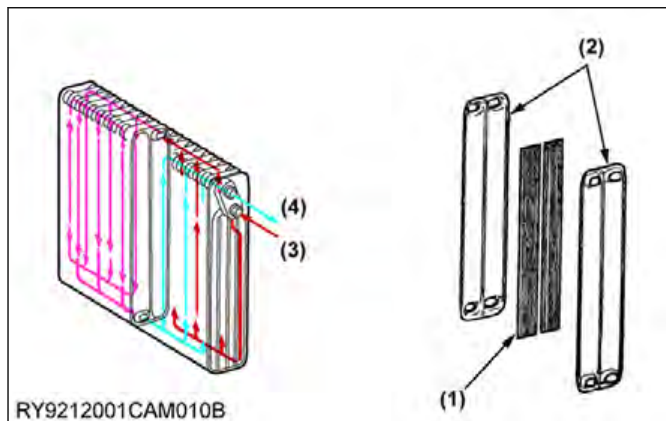
(c) Coolant inlet
(d) Coolant outlet

	Specifications	Remarks
Air conditioning performance	2.7 to 3.3 kW	At 2496 rpm (compressor) At 35 °C ambient temperature At 95 °F ambient temperature
Air conditioning air flow rate	225 to 275 m ³ /h	—
Heater performance	2.52 to 3.08 kW	At 6 L/min (coolant) At 1.6 U.S.gals/min (coolant) With coolant 65 °C hotter than ambient temperature With coolant 149 °F hotter than ambient temperature
Heater air flow rate	135 to 165 m ³ /h	—
Mass	7 kg 15.4 lbs	—
Rated voltage	12 V	—

4.2 Air conditioning unit function and structure

4.2.1 Evaporator

Cools down the air which flows through the evaporator by the evaporation heat.

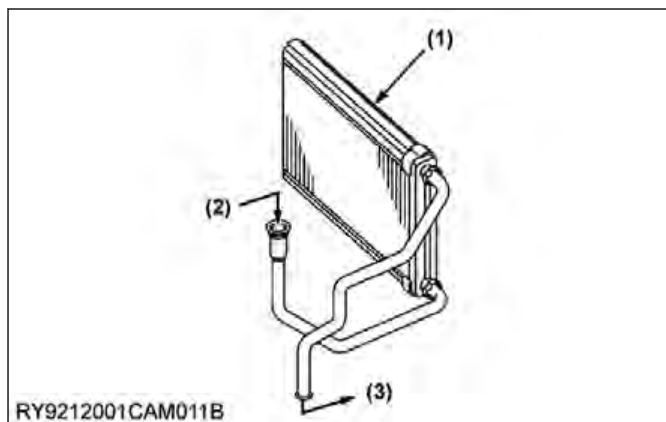


- (1) Fin
(2) Tube
(3) Refrigerant inlet
(4) Refrigerant outlet

- The expansion valve sprays the refrigerant into the evaporator.
- The refrigerant is evaporated due to the sudden pressure decrease.
- The evaporator cools down the cabin and ambient inlet air by taking the evaporation heat.

4.2.2 Heater core

Heats up the air which flows through the heater core by the heat convection.

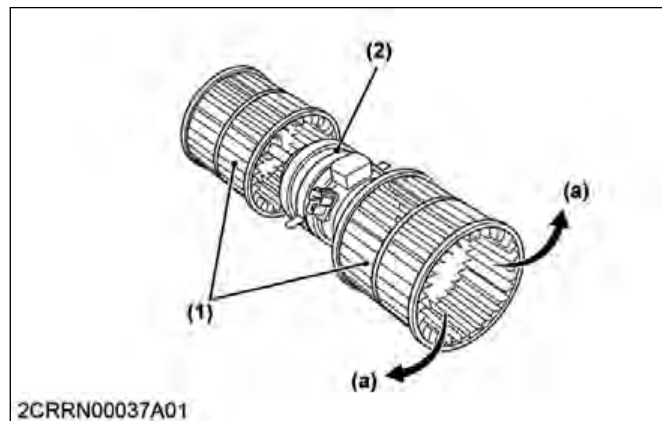


- (1) Heater core
(2) Coolant inlet
(3) Coolant outlet

- The heated coolant flows into the heater core.
- The heater core heats up the air which flows through the heater core by the heat convection.

4.2.3 Blower

Blows the air to the evaporator and heater core.

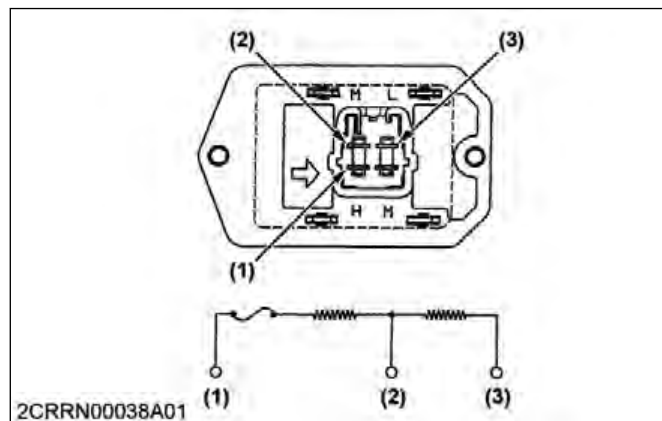


- (1) Fan
(2) Blower motor
(a) Air flow

- The blower motor rotates the fan.
- The fan blows the air from inside to outside.
- The air flows to the evaporator and heater core.

4.2.4 Blower resistor

Controls the rotating speed of the blower.

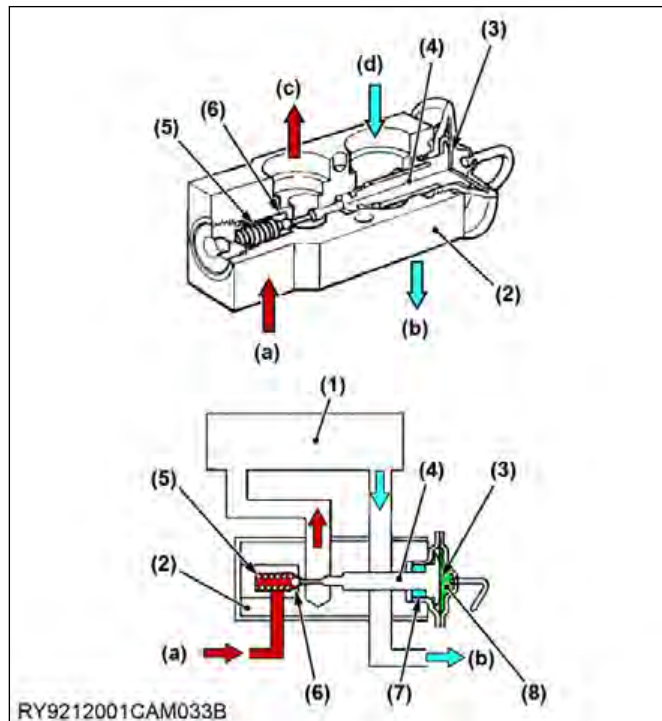


- (1) [HI]
(2) [MID]
(3) [LO]

- The fan switch shifts the current flow in the blower resistor.
- The fan switch [1] operation conducts the electrical current from the [HI] terminal to the [LO] terminal, and the blower motor rotates at low speed due to the high resistance.
- The fan switch [2] operation conducts the electrical current from the [HI] terminal to the [MID] terminal, and the blower motor rotates at higher speed due to the low resistance.
- The fan switch [3] operation cuts off the electrical current to the resistor, and the blower motor rotates at the highest speed due to no resistance.

4.2.5 Expansion valve

Sprays the optimal volume of the refrigerant into the evaporator depending on the temperature and pressure of the gas refrigerant.

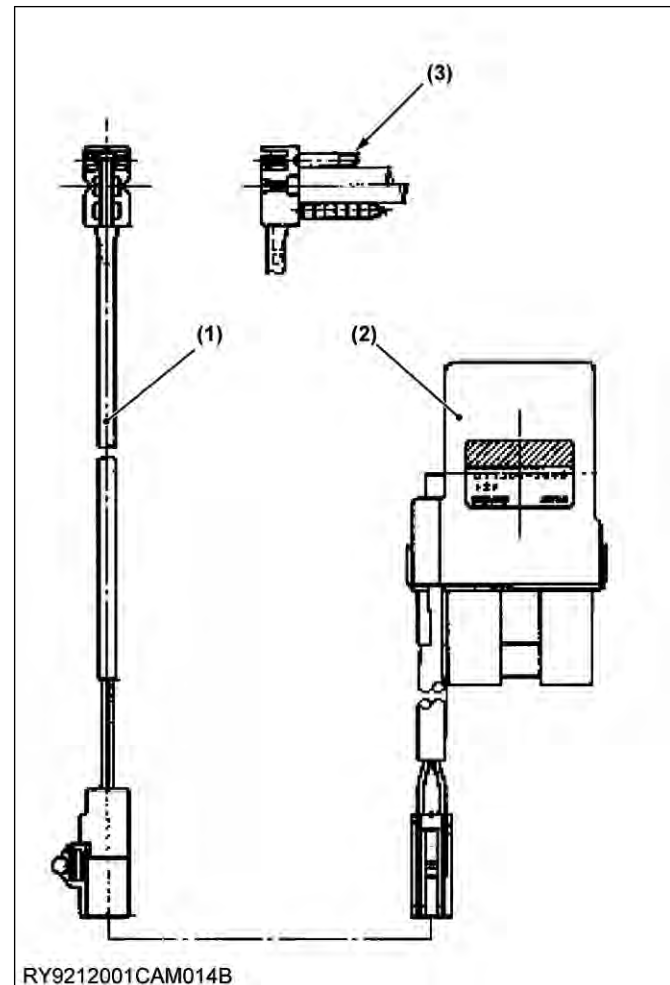


- | | |
|----------------------------|---------------------------------------|
| (1) Evaporator | (8) Charged refrigerant |
| (2) Expansion valve | (a) From the receiver (high pressure) |
| (3) Diaphragm | (b) To the compressor (low pressure) |
| (4) Thermo-sensitive rod | (c) To the evaporator |
| (5) Spring | (d) From the evaporator |
| (6) Needle valve | |
| (7) Evaporated refrigerant | |

- The refrigerant flows into the expansion valve and is sprayed into the evaporator through the needle valve.
- The evaporated refrigerant returns into the expansion valve and presses the diaphragm.
- The refrigerant presses the diaphragm against the evaporated refrigerant.
- The expansion valve controls the spraying volume depending on the balance of the evaporated refrigerant pressure, refrigerant, and needle valve spring.
 - The needle valve decreases the spraying volume as the evaporated refrigerant pressure increases.
 - The spraying volume increases as the charged refrigerant pressure increases due to the temperature increase.

4.2.6 Thermostat

Cuts off the current flow to the compressor's magnetic clutch to prevent the evaporator frosting in case that the evaporator is overcooled.

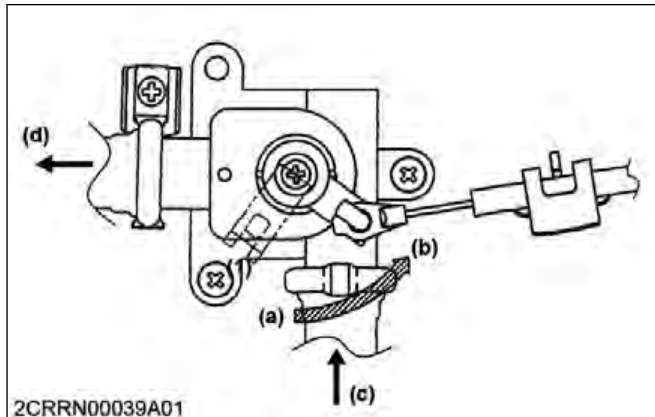


- | | |
|----------------------|----------------|
| (1) Thermostat | (3) Thermistor |
| (2) Thermo-amplifier | |

- The thermistor converts the evaporator temperature to the electric resistance.
- The temperature decreases, the resistance increases, and the thermo-amplifier cuts off the current flow to the compressor's magnetic clutch to prevent the evaporator frosting.

4.2.7 Heater valve

Adjusts the coolant flow rate according to the motion of the servomotor.

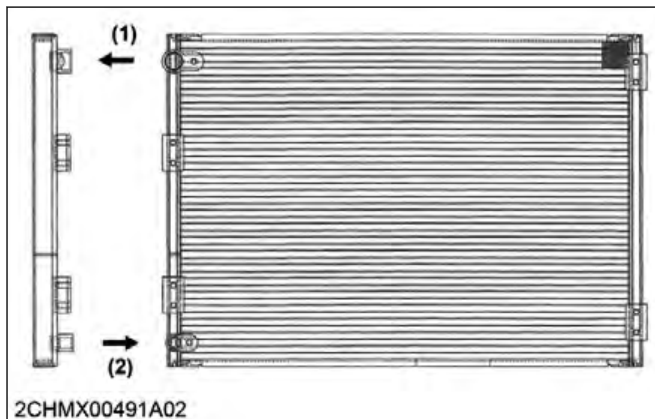


- (a) Open (c) Coolant inlet
(b) Close (d) Coolant outlet

- The servomotor connected to the heater valve controls the arm of the heater valve according to the air conditioning switch operation.
- The heater valve opens and the coolant flows into the heater core.

5. Condenser

5.1 Condenser specifications

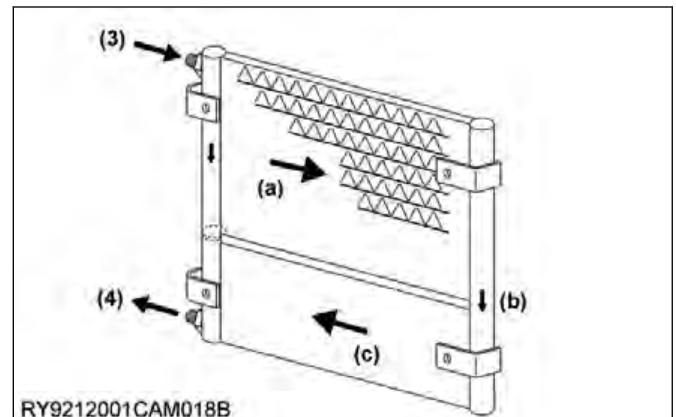
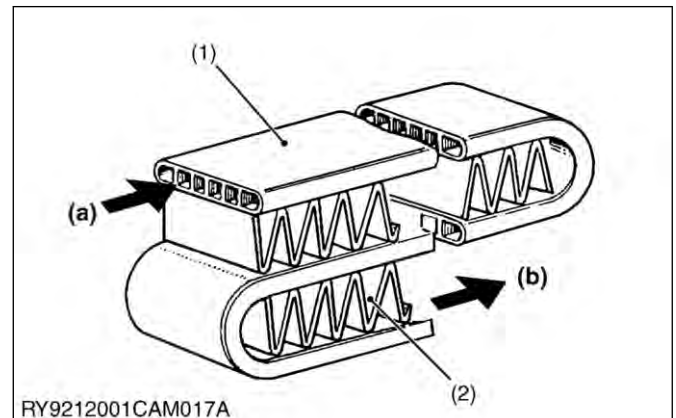


- (1) Refrigerant inlet (2) Refrigerant outlet

	Specifications
Manufacturer	Denso
Mass	1.9 kg 4.2 lbs

5.2 Condenser function and structure

Cools down and liquefies the discharged refrigerant by the heat convection.

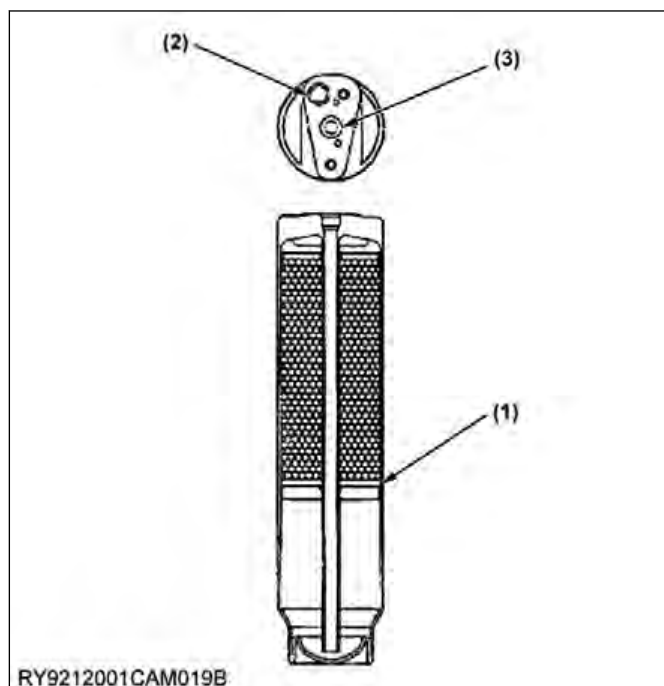


- (1) Tube (a) Gas
(2) Fin (b) Vapor
(3) Refrigerant inlet (c) Liquid
(4) Refrigerant outlet

- The discharged refrigerant flows into the condenser from the compressor.
- The condenser cools down and liquefies the refrigerant by the heat convection.

6. Receiver

6.1 Receiver specifications



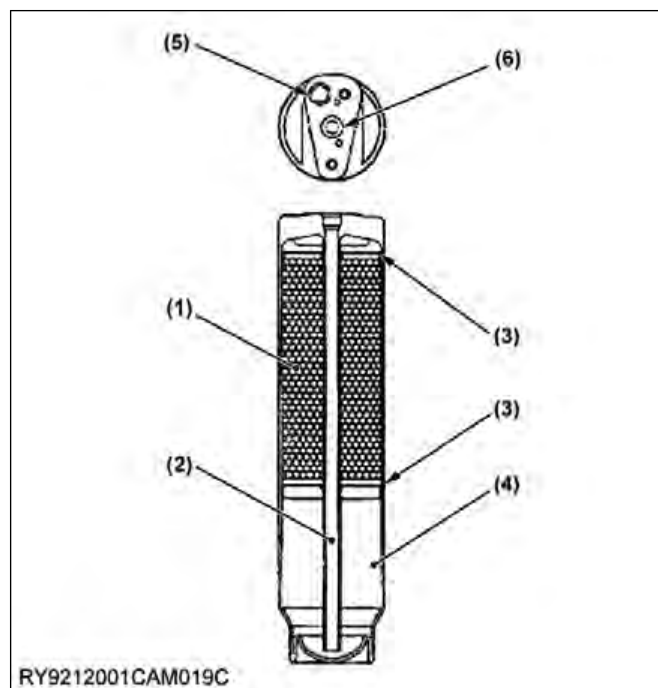
(1) Receiver
(2) Refrigerant inlet

(3) Refrigerant outlet

	Specifications
Capacity	0.55 L 0.15 U.S.gals
Hygroscopic capacity	32 g 1.27 lbs
Pressure capacity	5.30 MPa 54.0 kg/cm ² 769 psi

6.2 Receiver function and structure

Removes water and contamination from the liquid refrigerant and accumulates the refrigerant.



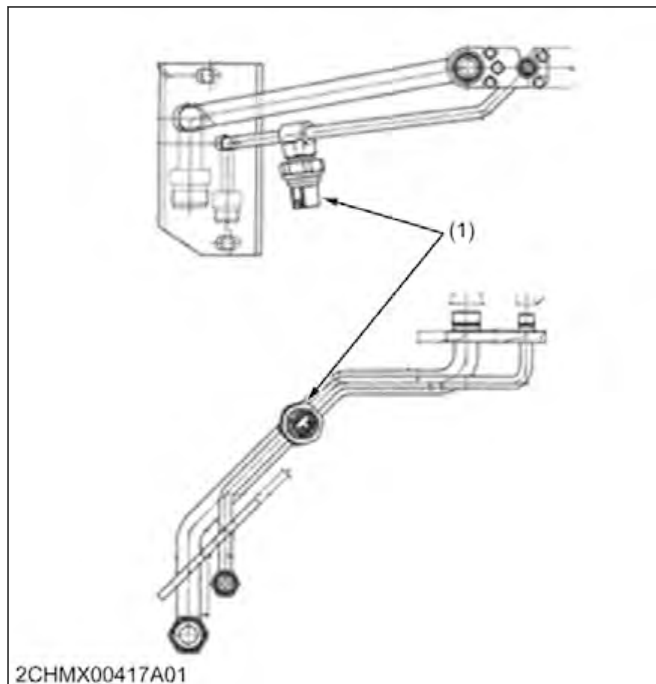
RY9212001CAM019C

(1) Dryer
(2) Tube
(3) Strainer
(4) Tank
(5) Refrigerant inlet
(6) Refrigerant outlet

- The liquid refrigerant flows into the receiver.
- The refrigerant flows through the dryer and the dryer absorbs water in the refrigerant.
- The refrigerant flows through the strainer and the strainer filters contamination in the refrigerant.
- The refrigerant flows into the tank. The tank accumulates the refrigerant to supply sufficient amount of refrigerant constantly to the expansion valve even if the compressor stops temporarily.

7. Pressure switch

7.1 Pressure switch specifications



(1) Pressure switch

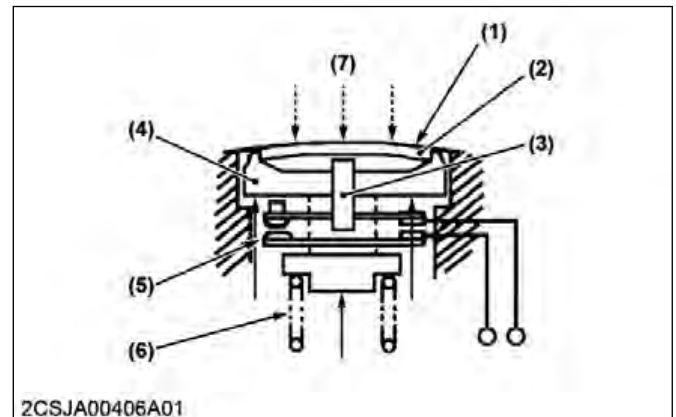
	Specifications	
Cut-off pressure	Low	0.194 to 0.198 MPa 1.8 to 2.2 kgf/cm ² 28.1 to 28.7 psi
	High	2.94 to 3.34 MPa 30.0 to 34.0 kgf/cm ² 426.4 to 484.4 psi

7.2 Pressure switch function and structure

Cuts off the current flow to the compressor's magnetic clutch to protect the air conditioning devices in the case

that the liquid refrigerant pressure is extremely low or high.

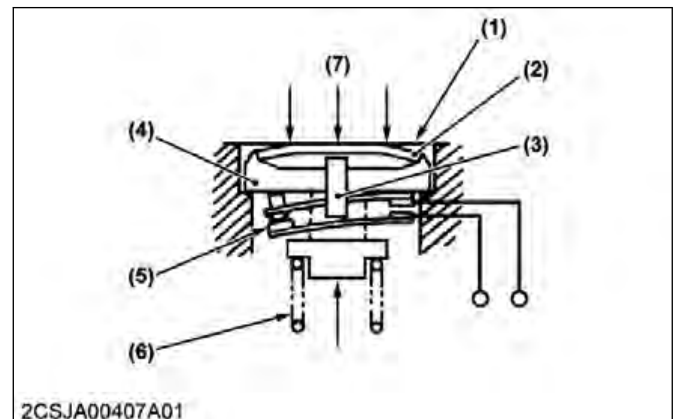
When the refrigerant pressure is extremely low



- | | |
|------------------|-----------------|
| (1) Diaphragm | (5) Electrode |
| (2) Spring plate | (6) Spring |
| (3) Pin | (7) Refrigerant |
| (4) Plate | |

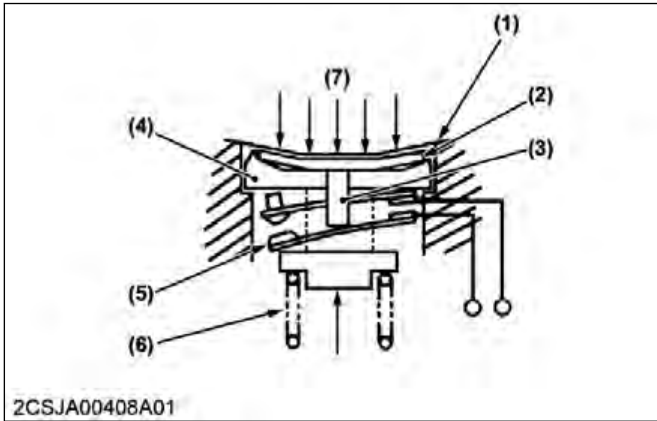
- The spring presses the plate.
- The separated electrodes cut off the current flow to the compressor's magnetic clutch to protect the compressor.

When the refrigerant pressure is normal



- | | |
|------------------|-----------------|
| (1) Diaphragm | (5) Electrode |
| (2) Spring plate | (6) Spring |
| (3) Pin | (7) Refrigerant |
| (4) Plate | |

- The refrigerant presses the plate against the spring.
- The contacted electrodes conduct the current flow to the compressor's magnetic clutch.

When the refrigerant pressure is extremely high

- | | |
|------------------|-----------------|
| (1) Diaphragm | (5) Electrode |
| (2) Spring plate | (6) Spring |
| (3) Pin | (7) Refrigerant |
| (4) Plate | |

- The refrigerant presses the pin.
- The pin separates the electrodes.
- The separated electrodes cut off the current flow to the compressor's magnetic clutch not to increase the refrigerant pressure to protect the air conditioning devices.

SERVICING

1. Troubleshooting

1.1 Air conditioning troubleshooting

Air conditioning is not working effectively

Causes	Inspections	Actions
The condenser is clogged.	Check the condition of the condenser.	Clean the condenser.
The connector is disconnected.	Check the connection of the related connectors.	Reconnect the connector.
The fuse or slow blow fuse has blown.	Check the conduction of the related fuses and slow blow fuses.	Specify the cause of the fuse blowing and replace the fuse.
The relay is malfunctioning.	Check the conduction of the related relays.	Replace the relay.
The air conditioning switch is malfunctioning.	Operate the air conditioning switch and check the responses from the air conditioning devices.	Replace the air conditioning switch.
The air conditioning belt is slipping.	Check the tension of the air conditioning belt.	Adjust the tension of the air conditioning belt.
The refrigerant is undercharged.	Check the condition of the refrigerant from the sight glass on the receiver. Check the pressure of the refrigerant with a manifold gauge.	Specify the cause of the undercharging and charge the refrigerant.
Air is mixed in the refrigerant circuit.	Check the condition of the refrigerant from the sight glass on the receiver.	Specify the cause of air mixing and charge the refrigerant.
The compressor is malfunctioning.	Check the flow of the refrigerant from the sight glass on the receiver. Check the pressure of the refrigerant with a manifold gauge.	Replace the compressor.
The refrigerant is overcharged.	Check the condition of the refrigerant from the sight glass on the receiver. Check the pressure of the refrigerant with a manifold gauge.	Charge the refrigerant after vacuuming.
The pressure switch is malfunctioning.	Check the conduction of the pressure switch.	Replace the pressure switch.
The expansion valve is malfunctioning.	Check the pressure of the refrigerant with a manifold gauge.	Replace the expansion valve.
The air gap of the magnetic clutch is too large.	Check the air gap of the magnetic clutch.	Adjust the air gap of the magnetic clutch with the shim.
The magnetic clutch is malfunctioning.	Check the flow of the refrigerant from the sight glass on the receiver. Check the pressure of the refrigerant with a manifold gauge.	Replace the magnetic clutch.
The evaporator is clogged or frosted.	Check the condition of the evaporator.	Clean the evaporator.
The thermostat is malfunctioning.	Check the conduction of the thermostat.	Replace the thermostat.
The receiver is clogged.	Check the flow of the refrigerant from the sight glass on the receiver. Check the pressure of the refrigerant with a manifold gauge.	Replace the receiver.

(Continued)

Causes	Inspections	Actions
The wire harness is damaged.	Check the conduction of the related wire harnesses.	Repair or replace the wire harness.

Heater is not working effectively

Causes	Inspections	Actions
The heater hose is bent, damaged or pinched.	Check the bend, damage, and pinch of the heater hoses.	Replace the heater hose.
The connector is disconnected.	Check the connection of the related connectors.	Reconnect the connector.
The fuse or slow blow fuse has blown.	Check the conduction of the related fuses and slow blow fuses.	Specify the cause of the fuse blowing and replace the fuse.
The heater valve is clogged.	Check the condition of the heater valve.	Replace the heater valve.
The air conditioning switch is malfunctioning.	Operate the air conditioning switch and check the responses of the air conditioning devices.	Replace the air conditioning switch.
The wire harness is damaged.	Check the conduction of the related wire harnesses.	Repair or replace the wire harness.

Discharged air is too cold

Causes	Inspections	Actions
The thermostat is malfunctioning.	Check the conduction of the thermostat.	Replace the thermostat.
The air conditioning switch is malfunctioning.	Operate the air conditioning switch and check the responses from the air conditioning devices.	Replace the air conditioning switch.
The heater valve is clogged.	Check the condition of the heater valve.	Replace the heater valve.
The heater hose is bent, damaged or pinched.	Check the bend, damage, and pinch of the heater hoses.	Replace the heater hose.

Discharged air is too hot

Causes	Inspections	Actions
The air conditioning switch is malfunctioning.	Operate the air conditioning switch and check the responses from the air conditioning devices.	Replace the air conditioning switch.

Air flow is insufficient

Causes	Inspections	Actions
The air filter is clogged.	Check the condition of the air filters.	Clean the air filter. Replace the air filter.
The air vent is clogged.	Check the condition of the air vents.	Clean the air vent. Replace the air vent.
The evaporator is clogged or frosted.	Check the condition of the evaporator.	Clean the evaporator.
The connector is connected insecurely.	Check the connection of the related connectors.	Reconnect the connector.
The fan switch is damaged.	Check the conduction of the fan switch.	Replace the fan switch.
The fan is deformed.	Check for the deformation of the fan.	Replace the blower.
The blower motor is malfunctioning.	Check the motion of the blower motor.	Replace the blower.
The blower resistor is damaged.	Check the resistance of the blower resistor.	Replace the blower resistor.
The air duct is detached.	Check the connections of the air ducts.	Reinstall the air duct.
The wire harness is damaged.	Check the conduction of the related wire harnesses.	Repair or replace the wire harness.
The air duct is clogged.	Check the condition of the air ducts.	Clean the air duct. Replace the air duct.

There is no air flow

Causes	Inspections	Actions
The fuse or slow blow fuse has blown.	Check the conduction of the related fuses and slow blow fuses.	Specify the cause of the fuse blowing and replace the fuse.
The relay is malfunctioning.	Check the conduction of the related relays.	Replace the relay.
The air duct is detached.	Check the connections of the air ducts.	Reinstall the air duct.
The connector is disconnected.	Check the connection of the related connectors.	Reconnect the connector.
The wire harness is damaged.	Check the conduction of the related wire harnesses.	Repair or replace the wire harness.
The fan switch is damaged.	Check the conduction of the fan switch.	Replace the fan switch.
The fan is deformed.	Check for the deformation of the fan.	Replace the blower.
The blower motor is malfunctioning.	Check the motion of the blower motor.	Replace the blower.
The blower resistor is damaged.	Check the resistance of the blower resistor.	Replace the blower resistor.
The air duct is clogged.	Check the condition of the air ducts.	Clean the air duct. Replace the air duct.
The air vent is clogged.	Check the condition of the air vents.	Clean the air vent. Replace the air vent.

A noise is heard

Causes	Inspections	Actions
The air conditioning belt is slipping.	Check the tension of the air conditioning belt.	Adjust the tension of the air conditioning belt.
The compressor is malfunctioning.	Check for the noise of the compressor.	Replace the compressor.
The blower motor is malfunctioning.	Check for the noise of the blower motor.	Replace the blower.
The refrigerant is overcharged.	Check the condition of the refrigerant from the sight glass on the receiver. Check the pressure of the refrigerant with a manifold gauge.	Charge the refrigerant after vacuuming.
The refrigerant is undercharged.	Check the condition of the refrigerant from the sight glass on the receiver. Check the pressure of the refrigerant with a manifold gauge.	Specify the cause of the undercharging and charge the refrigerant.
The fan is deformed.	Check for the noise of the fan. Check for the deformation of the fan.	Replace the blower.
The air duct is detached.	Check the connections of the air ducts.	Reinstall the air duct.
The air duct is clogged.	Check the condition of the air ducts.	Clean the air duct. Replace the air duct.
The air vent is clogged.	Check the condition of the air vents.	Clean the air vent. Replace the air vent.

2. Service specifications

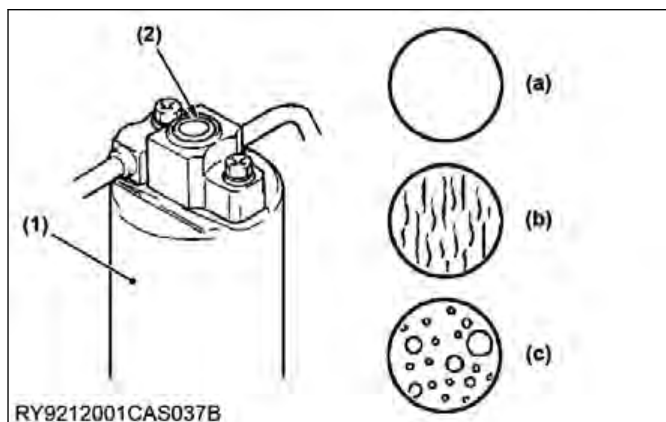
2.1 Service specifications for air conditioning and heater system

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Amount	Refrigerant		g lbs	650 1.43	±50 ±0.11	—
Air gap	Magnetic clutch		mm in.	0.5 0.02	-0.20 to +0.15 -0.008 to +0.006	—
Pressure	Refrigerant	High pressure	MPa kgf/cm ² psi	1.47 15.0 213	±0.20 ±2.0 ±29	—
		Low pressure	MPa kgf/cm ² psi	0.18 1.8 26	±0.03 ±0.3 ±4	—

3. Testing

3.1 Checking the refrigerant

1. Open the cabin door and windows.
2. Start the engine and accelerate the engine speed to 1500 rpm.
3. Turn on the air conditioning switch and adjust the temperature switch to the coolest level.
4. Turn the fan switch to the maximum air flow ([3] level).
5. Check the refrigerant level from the sight glass on the receiver.



(1) Receiver (2) Sight glass

(a)	Overcharged	No air bubble in the refrigerant flow.
(b)	Properly charged	A few bubbles in the refrigerant flow at the idling speed. The bubbles disappear gradually while accelerating the engine speed to 1500 rpm.
(c)	Undercharged	Air bubbles flows constantly.

6. Stop the engine.

7. Vacuum or charge the refrigerant if necessary.

3.2 Measuring the refrigerant pressure

Measure the refrigerant pressure with a manifold gauge to check the condition of the cooling circuit.



CAUTION

- Wear gloves, work clothing, and eye protector to protect your skin and eyes. The liquid refrigerant may cause the frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.

IMPORTANT

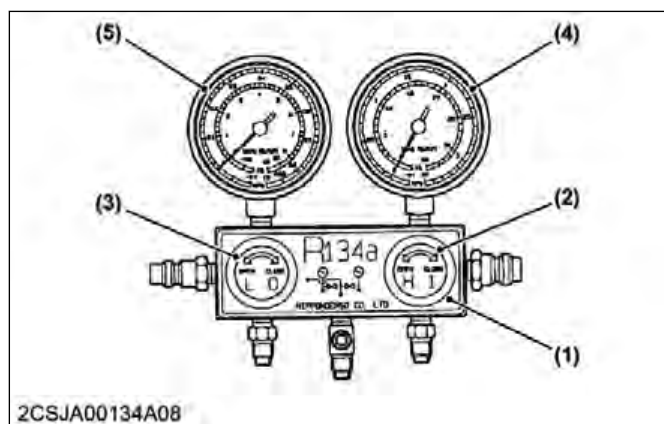
- The R134a refrigerant must be handled by trained personnel when measuring, vacuuming, or charging.
- Work at the clean and dry work space with clean and dry tools.
- Follow the manifold gauge manufacturer's manual for details when handling the manifold gauge.

Preparing

1. Open the rear bonnet.

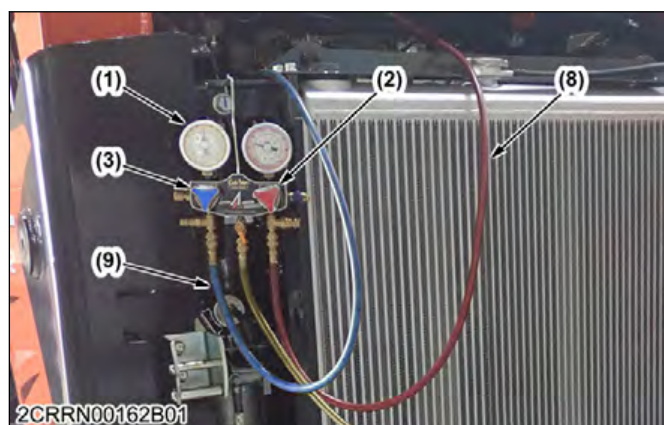
Measuring

1. Close the high and low pressure valves of the manifold gauge.



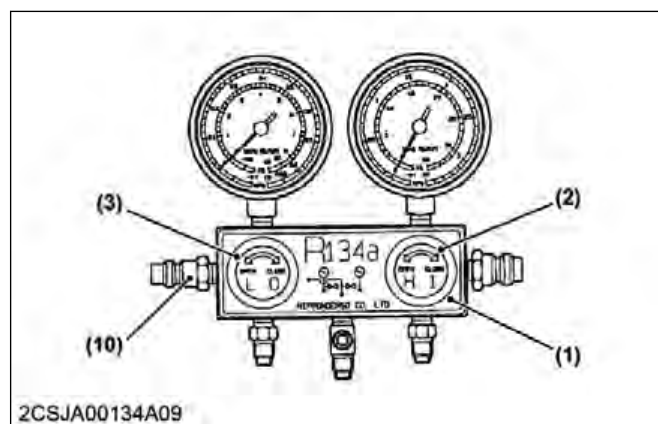
- (1) Manifold gauge (4) High pressure gauge
(2) High pressure valve (5) Low pressure gauge
(3) Low pressure valve

2. Connect the red charging hose to the high pressure charging port and the blue charging hose to the low pressure charging port.



- (1) Manifold gauge (8) Refrigerant charging hose (red)
(2) High pressure valve (9) Refrigerant charging hose (blue)
(3) Low pressure valve
(6) High pressure charging port ([H] mark)
(7) Low pressure charging port ([L] mark)

3. Open the low pressure valve of the manifold gauge slightly and press the air bleeding valve to release the air in the blue charging hose and manifold gauge.



- (1) Manifold gauge (10) Air bleeding valve
(2) High pressure valve
(3) Low pressure valve

4. Close the low pressure valve of the manifold gauge after bleeding air completely.
5. Open the high pressure valve of the manifold gauge slightly and press the air bleeding valve to release the air in the red charging hose and manifold gauge.
6. Close the high pressure valve of the manifold gauge after bleeding air completely.
7. Start the engine and open the cab door and windows.
8. Turn on the air conditioning switch and adjust the temperature switch to the coolest level.
9. Turn the fan switch to the maximum air flow ([3] level).
10. Warm up the engine in the idling speed to warm up the refrigerant.
11. Accelerate the engine speed to 1500 rpm.
12. Turn the fan switch to the maximum air flow ([3] level).
13. Measure the high and low pressure of the refrigerant.

NOTE

- Close the cab door and windows if the ambient temperature is exceeding 40 °C (104 °F).
- Turn the fan switch to the minimum air flow ([1] level) if the ambient temperature is exceeding 40 °C (104 °F).

Service specifications

High pressure	1.27 to 1.67 MPa 13.0 to 17.0 kgf/cm ² 184 to 242 psi
Low pressure	0.15 to 0.21 MPa 1.5 to 2.1 kgf/cm ² 22 to 30 psi

14. Stop the engine and disconnect the charging hoses.

■ **NOTE**

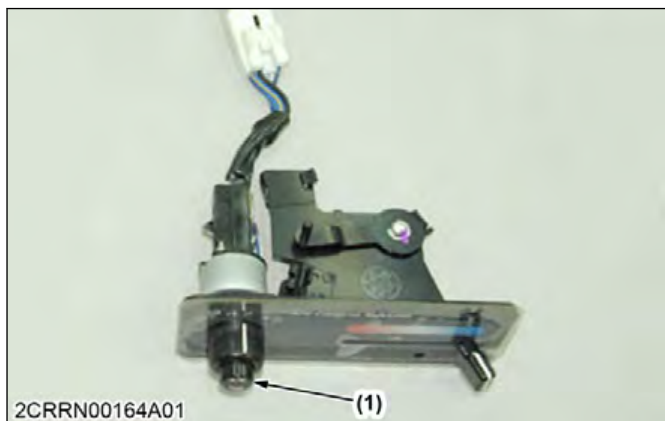
- Disconnect the charging hoses from the charging ports quickly to prevent refrigerant from leaking to the atmosphere.

3.3 Checking the fan switch

In order to check the status of the fan switch, examine the conduction of the fan switch in each operation.

Preparing

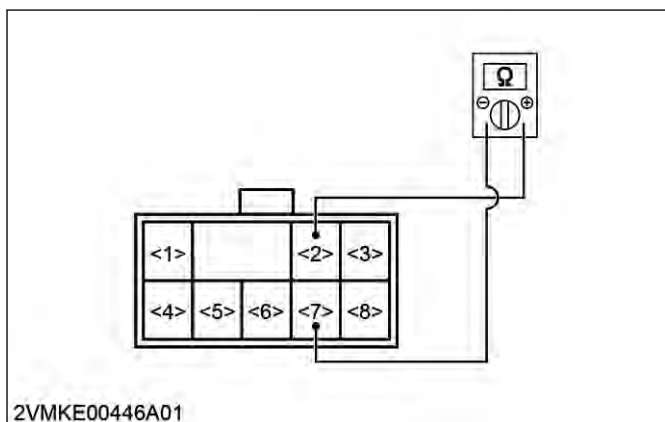
1. Stop the engine.
2. Disconnect the negative (-) terminal of the battery.
3. Disconnect the connector from the air conditioning panel.



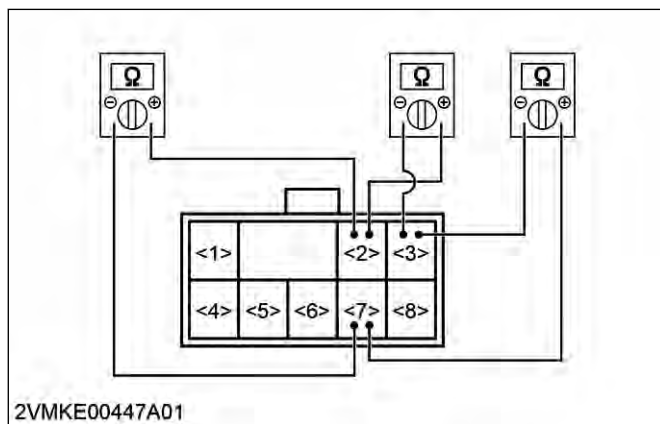
(1) Fan switch connector

Checking

1. Check the conduction of the fan switch [1] operation.

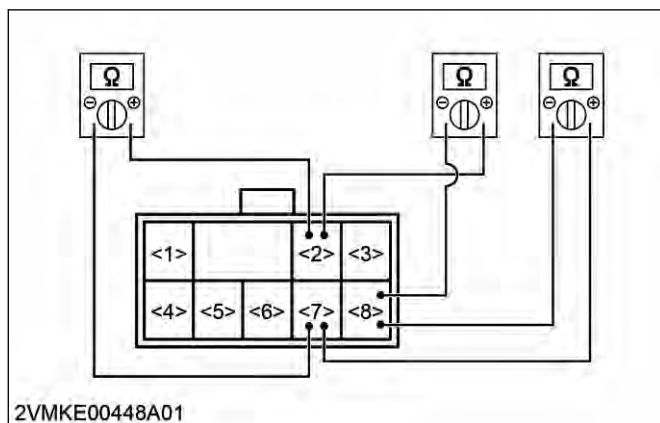


- The terminal 2 and 7 conduct.
2. Check the conduction of the fan switch [2] operation.



- The terminal 2 and 3 conduct.
- The terminal 2 and 7 conduct.
- The terminal 3 and 7 conduct.

3. Check the conduction of the fan switch [3] operation.



- The terminal 2 and 7 conduct.
- The terminal 2 and 8 conduct.
- The terminal 7 and 8 conduct.

3.4 Measuring the magnetic clutch pulley air gap

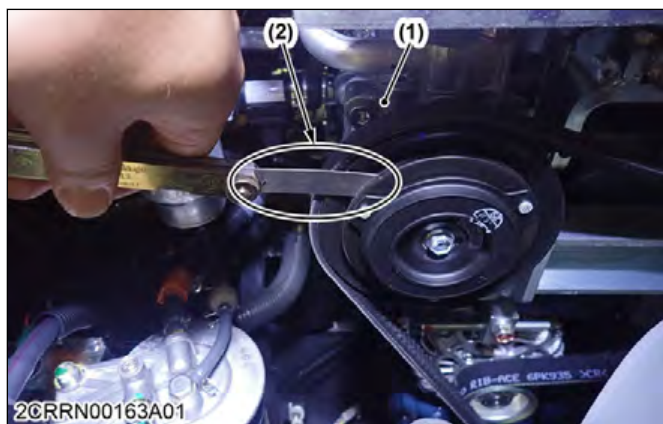
There is a possibility of the magnetic clutch trouble if the air conditioning is not working effectively. Measure the magnetic clutch pulley air gap and adjust as needed.

Preparing

1. Open the rear bonnet.
2. Stop the engine.

Measuring

1. Open the upper bonnet.
2. Check the air gap between the pulley and hub plate with a feeler gauge.

**Tightening torque**

(5) Bolt	15 to 21 N · m 1.6 to 2.1 kgf · m 11 to 15 lbf · ft	—
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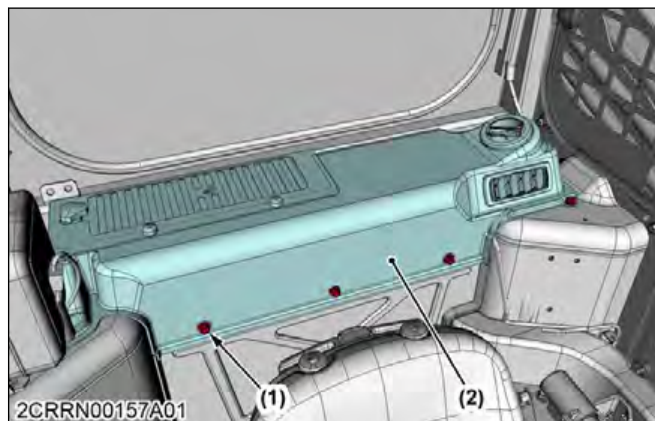
4. Check the air gap.

3.5 Checking the blower resister

Check the resistance of the blower resister in each operation.

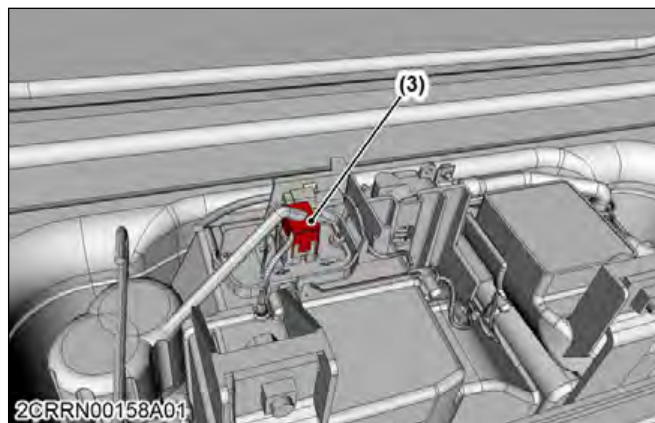
Checking

1. Remove the 8 screws.
2. Remove the cover.



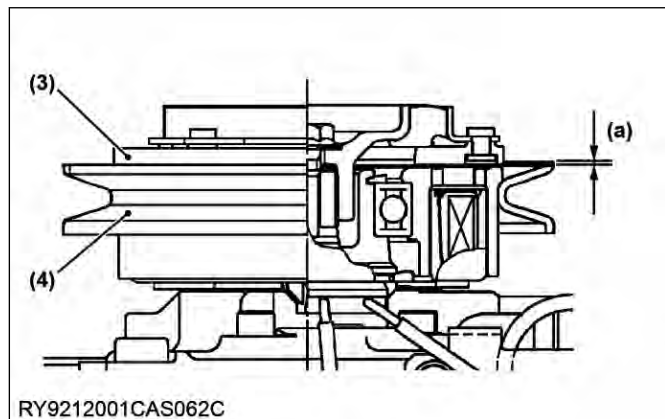
- (1) Screw ×8
- (2) Cover

3. Disconnect the blower resister connector.



- (3) Blower resister connector

4. Check the resistance of the blower resister.



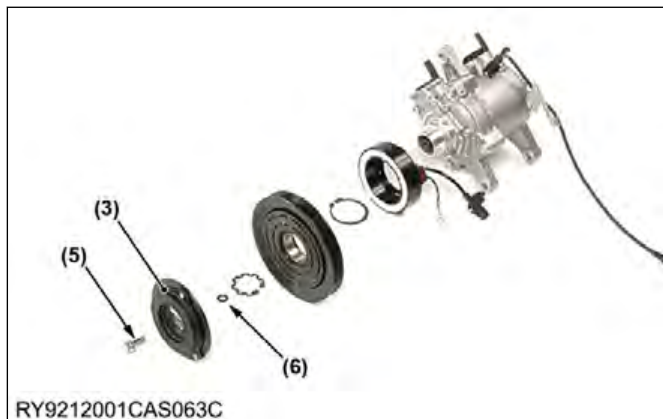
- (1) Compressor
- (2) Feeler gauge
- (3) Hub plate
- (4) Pulley
- (a) Air gap

Service specification

(a)	0.30 to 0.65 mm 0.012 to 0.026 in.
-----	---------------------------------------

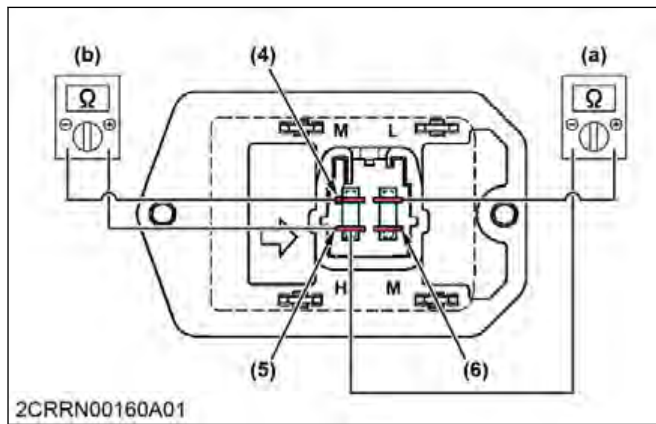
Adjusting

1. Remove the bolt and pulley.



- (3) Hub plate
- (4) Pulley
- (5) Bolt (M6 × 16)
- (6) Shim

2. Adjust the air gap by installing shims with a proper thickness.
3. Install the pulley and bolt.



- (4) [MID] (b) Fan switch [2] operation (conducting [HI] and [MID])
 (5) [HI]
 (6) [LO]
 (a) Fan switch [1] operation (conducting [HI] and [LO])

(a)	1.56 Ω
(b)	0.56 Ω

4. Repairing

4.1 Compressor

4.1.1 Removing and installing the compressor

⚠ CAUTION

- Wear gloves, work clothing, and eye protector to protect your skin and eyes. The liquid refrigerant may cause frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

■ IMPORTANT

- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using the parts which are not specified by R134a may cause leakage, performance decrement, and so on.
- Apply compressor oil to every O-ring to avoid damage when installing.

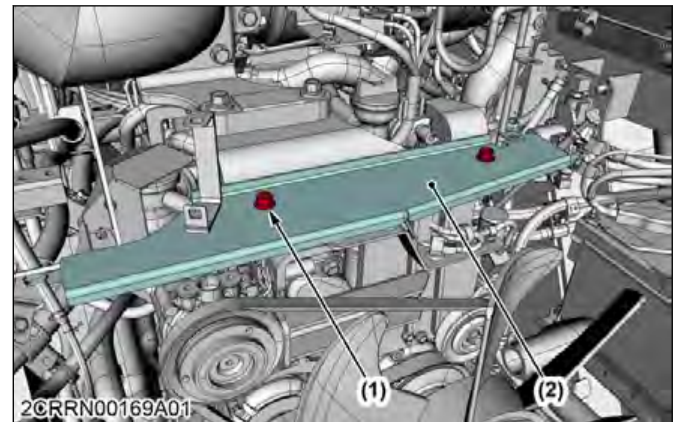
Preparing

1. Open the rear bonnet and insert the pin into the lock position.

2. Vacuum the refrigerant from the cooling circuit.
3. Tilt the radiator.

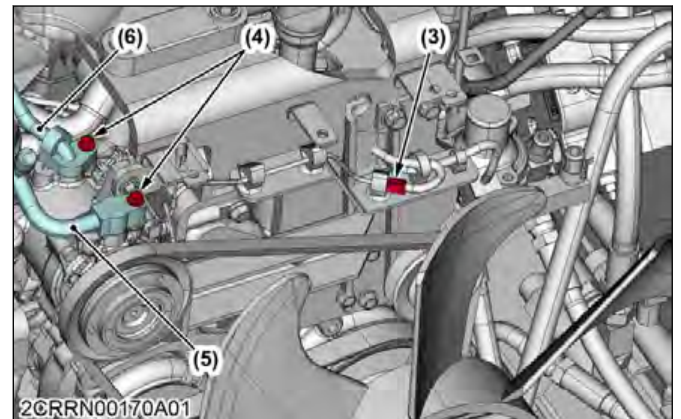
Removing

1. Open the upper bonnet.
2. Remove the 2 bolts, and remove the cover.



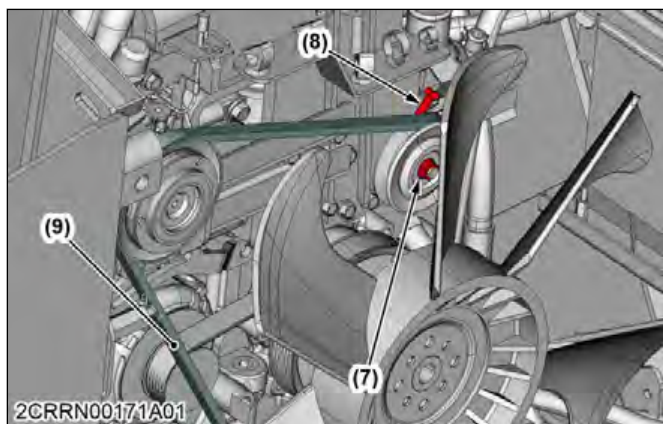
- (1) Bolt (M8 × 20) × 2 (2) Cover

3. Disconnect the connector.
4. Remove the 2 bolts, and disconnect the suction hose and discharging hose.



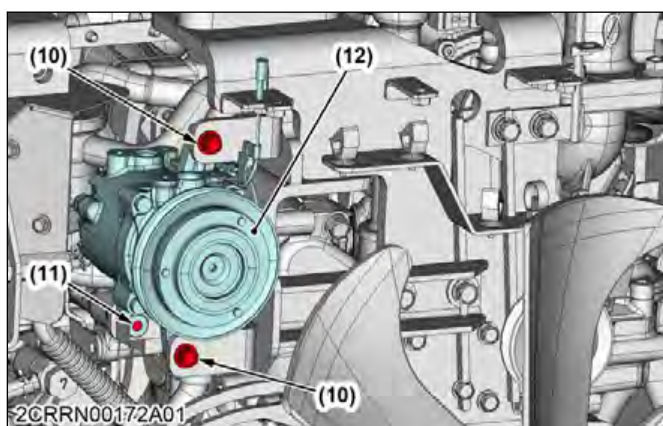
- (3) Connector (4) Bolt (M6 × 25) × 2
 (5) Suction hose (6) Discharging hose

5. Loosen the locknut.
6. Loosen the tension bolt and remove the air conditioning belt.



(7) Locknut (9) Air conditioning belt
(8) Tension bolt

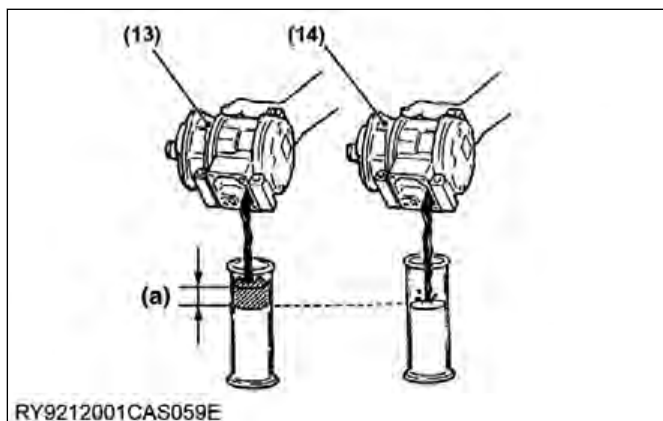
7. Remove 3 bolts and the compressor.



(10) Bolt (M8 × 25) × 2 (12) Compressor
(11) Bolt (M8 × 35)

Installing

1. Drain the compressor oil and measure the volume of the compressor oil in the removed and new compressors.



(13) New compressor (a) Excessive oil
(14) Removed compressor

NOTE

- New compressor contains 110 cc of compressor oil.

2. Replenish the compressor oil into the new compressor by the same volume as the removed compressor's.

NOTE

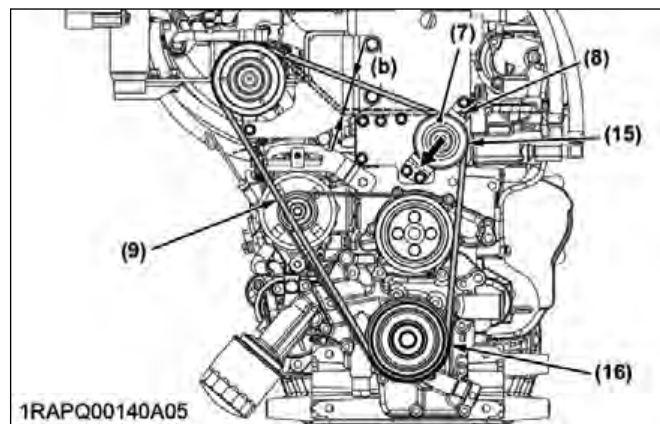
- Do not add excessive amount of the compressor oil into the cooling circuit.

3. Install the compressor.

NOTE

- Tighten the bolts near the magnetic clutch pulley first.
- Insert the bushing as the bushing flange seats between the compressor and bracket.

4. Install the air conditioning belt and adjust the tension of it.



(7) Locknut (15) Tension pulley
(8) Tension bolt (16) Crank pulley
(9) Air conditioning belt

5. Tighten the tension bolt and locknut.

Adjusting dimension

(b)	7.0 to 9.0 mm 0.27 to 0.35 in.	Push with 50 to 60 N Push with 5 to 6 kgf Push with 11.0 to 13.5 lbf
-----	-----------------------------------	--

Tightening torque

(7) Locknut	37.0 to 41.0 N·m 3.8 to 4.2 kgf·m 27.3 to 30.2 lbf·ft	—
(10), (11) Bolt	16.7 to 19.6 N·m 1.7 to 2.0 kgf·m 12.3 to 14.5 lbf·ft	—

6. Install the suction hose and discharge hose.

Tightening torque

(4) Bolt	7.9 to 11.8 N·m 0.8 to 1.2 kgf·m 5.8 to 8.7 lbf·ft	—
----------	--	---

7. Charge the refrigerant.

4.2 Air conditioning unit

4.2.1 Removing and installing the air conditioning unit



CAUTION

- Wear gloves, work clothing, and eye protector to protect your skin and eyes. The liquid refrigerant may cause frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

IMPORTANT

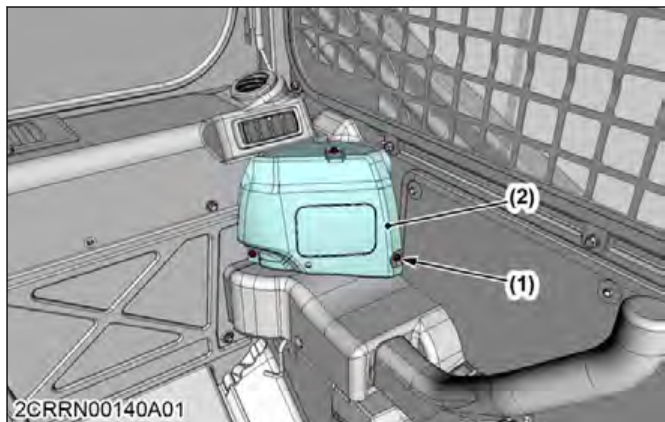
- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using parts which are not specified by R134a may cause leakage, performance decrement, and so on.
- When installing, apply compressor oil to every O-ring to avoid damage.

Preparing

1. Open the rear bonnet and insert the pin into the lock position.
2. Vacuum the refrigerant from the cooling circuit.
3. Drain the coolant.

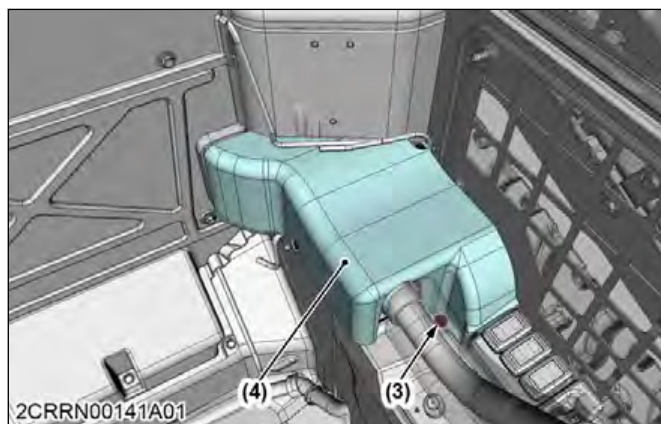
Removing

1. Remove the 3 screws.
2. Remove the cover.



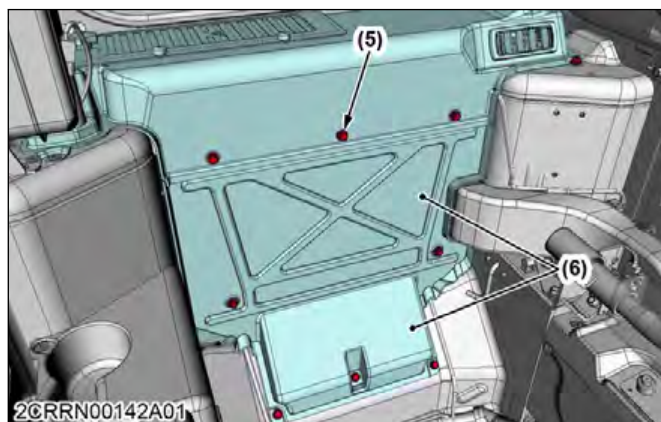
- (1) Bolt (M6 × 16) ×3 (2) Cover

3. Remove the 3 screws.
4. Remove the cover.



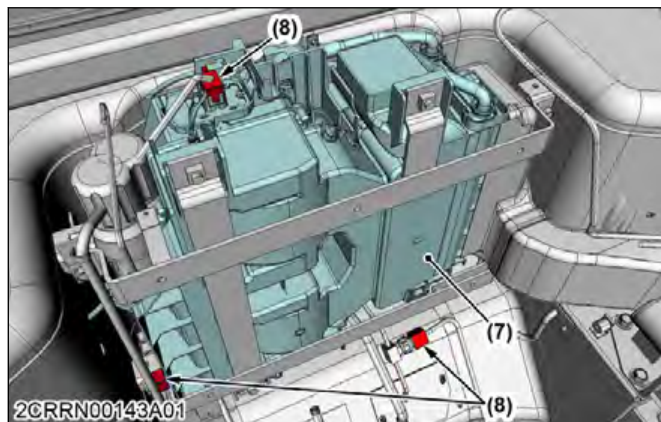
- (3) Bolt (M6 × 16) ×3 (4) Cover

5. Remove the 13 screws.
6. Remove the 2 covers.



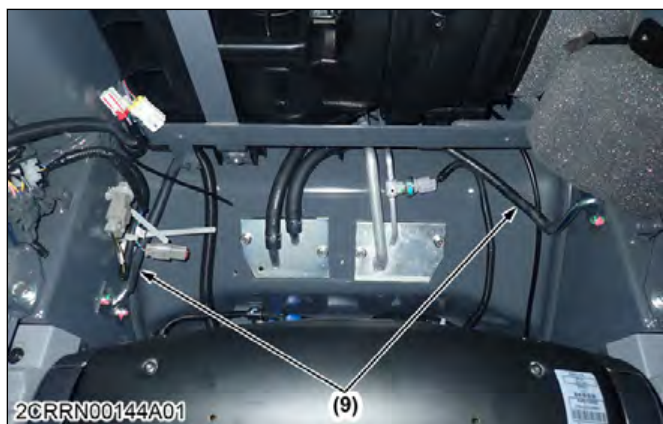
- (5) Bolt (M6 × 16) ×13 (6) Cover

7. Disconnect all of the connectors from the air conditioning unit.



- (7) Air conditioning unit (8) Connector

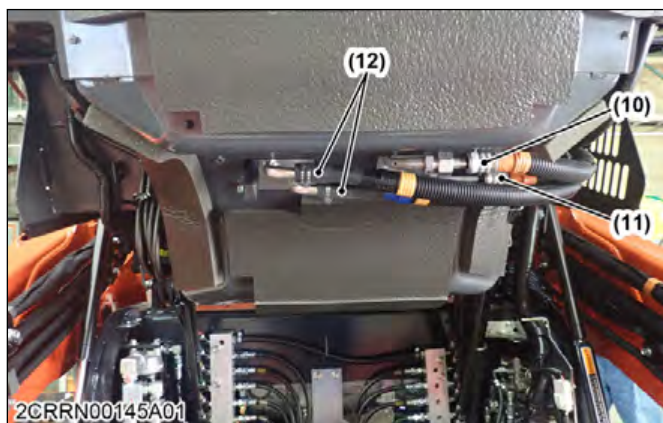
8. Remove the 2 drain hoses.



(9) Drain hose

9. Lift up the cab.

10. Disconnect the pressure hose, heater hose, and suction hose from the air conditioning unit.



(10) Suction hose

(12) Heater hose

(11) Pressure hose

11. Lift down the cab.

12. Unlock the stopper and the cable.

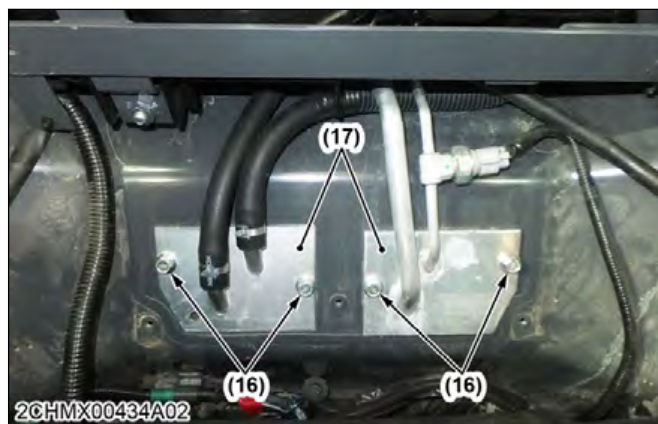


(13) Stopper

(15) Heater valve

(14) Cable

13. Remove the 4 bolts, and remove the 2 hose pipes.

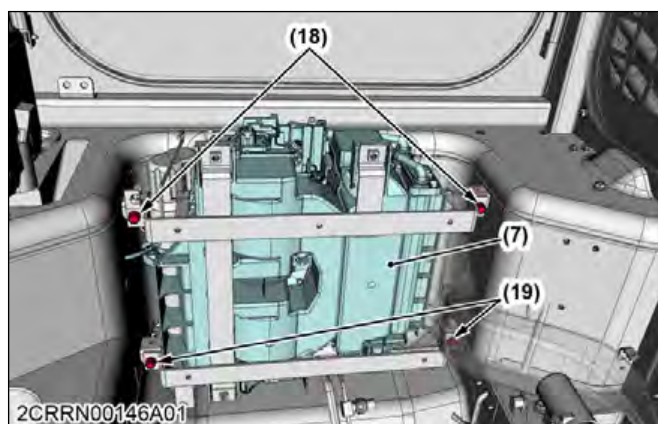


(16) Bolt (M8 × 20) × 4

(17) Hose pipe

14. Remove the 2 nuts and 2 bolts.

15. Remove the air conditioning unit.



(7) Air conditioning unit

(19) Bolt (M10 × 25) × 2

(18) Nut × 2

Mass

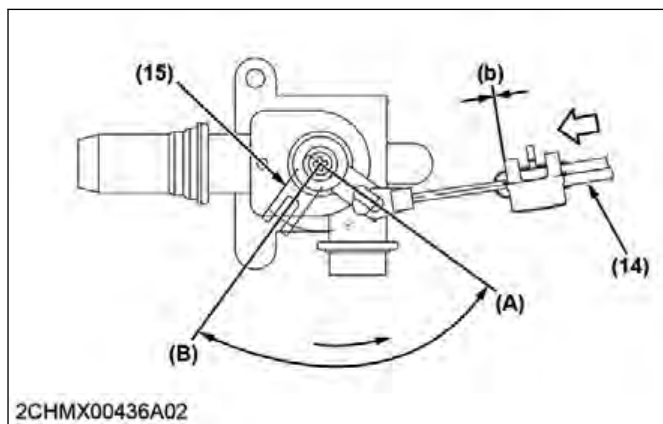
(7) Air conditioning unit	Approximately 7.0 kg Approximately 15.4 lbs
---------------------------	--

Installing

■ IMPORTANT

- Charge the refrigerant after installing.
- Replenish the coolant into the engine after installing.
- Adjust the dimension of the cable so that the air conditioning performance does not decrease.

1. Attach the cable to the heater valve with pulling the cable to the direction of the arrow.



- (14) Cable (B) Open
(15) Heater valve
(A) Close

Adjusting dimension

(b)	0 mm 0 in.
-----	---------------

Tightening torque

(1), (3), (5) Bolt	5.0 to 6.0 N · m 0.5 to 0.6 kgf · m 3.7 to 4.4 lbf · ft	—
(16) Bolt	23.5 to 27.5 N · m 2.4 to 2.8 kgf · m 17.3 to 20.3 lbf · ft	—
(18) Nut	48.1 to 55.9 N · m 4.9 to 5.7 kgf · m 35.5 to 41.2 lbf · ft	—
(19) Bolt	48.1 to 55.9 N · m 4.9 to 5.7 kgf · m 35.5 to 41.2 lbf · ft	—

4.2.1.1 Removing the evaporator

⚠ CAUTION

- Wear gloves, work clothing, and eye protector to protect your skin and eyes. The liquid refrigerant may cause the frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

■ IMPORTANT

- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using

parts which are not specified by R134a may cause leakage, performance decrement, and so on.

Preparing

1. Vacuum the refrigerant from the cooling circuit.
2. Remove the air conditioning unit.
3. Remove the heater valve and heater core.
4. Remove the expansion valve.

Removing

1. Remove the fin thermistor and evaporator.



- (1) Fin thermistor (2) Evaporator

4.2.1.2 Removing and installing the heater core

⚠ CAUTION

- Keep fire and flammable items away from the working area.

■ IMPORTANT

- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.

Preparing

1. Vacuum the refrigerant from the cooling circuit.
2. Remove the air conditioning unit.

Removing

1. Remove the 4 screws.



(1) Screw ×4

2. Pull out the heater core from the air conditioning unit.



(2) Heater core

3. Remove the 2 screws and disconnect the 2 heater pipes from the heater valve.



(3) Screw ×2

(5) Heater valve

(4) Heater pipe ×2

Installing

■ IMPORTANT

- Replenish the coolant into the engine after installing.

Tightening torque

(1), (3) Screw	1.3 to 1.5 N · m 0.14 to 0.15 kgf · m 0.96 to 1.1 lbf · ft	—
----------------	--	---

4.2.1.3 Removing the blower



CAUTION

- Keep fire and flammable items away from the working area.

■ IMPORTANT

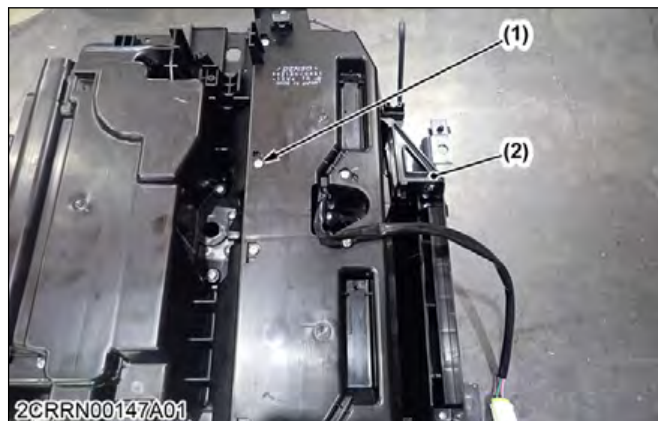
- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.

Preparing

1. Vacuum the refrigerant from the cooling circuit.
2. Remove the air conditioning unit.
3. Remove the heater valve and heater core.

Removing

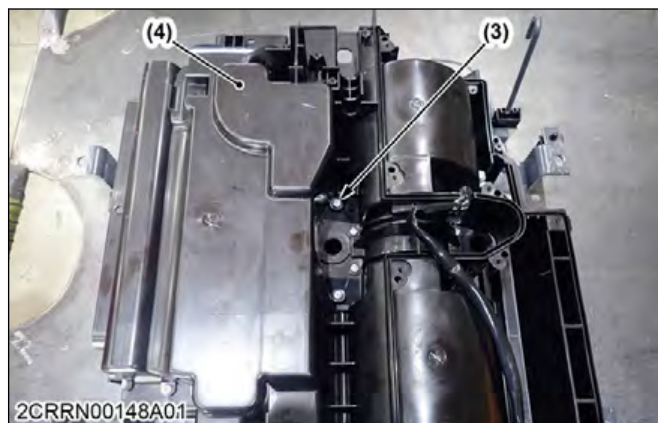
1. Remove the 13 screws and case.



(1) Screw ×13

(2) Case

2. Remove the 20 screws and case.



(3) Screw ×20

(4) Case

3. Remove the blower and blower motor.



(5) Blower (6) Blower motor

4. Remove the nut, and remove the blower from the blower motor.



(5) Blower (7) Nut

4.2.1.4 Removing the blower resistor



CAUTION

- Keep fire and flammable items away from the working area.

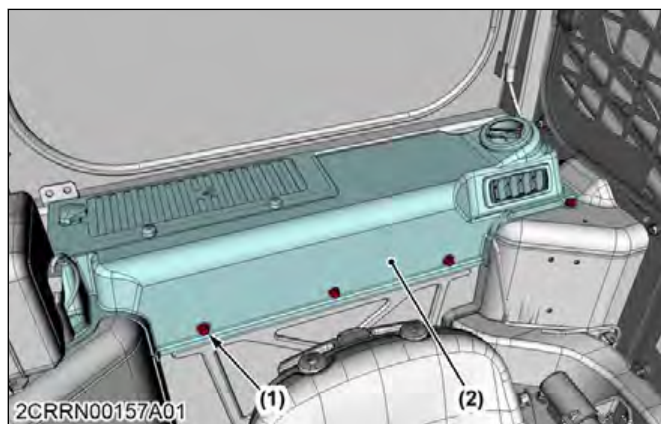


IMPORTANT

- Work at the clean and dry work space with clean and dry tools.

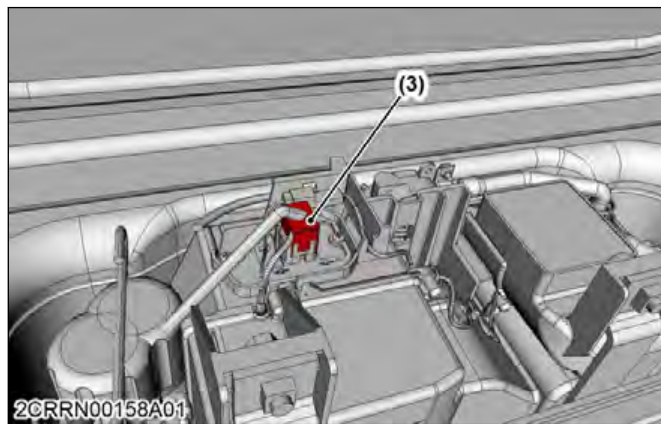
Removing

1. Remove the 8 screws.
2. Remove the cover.



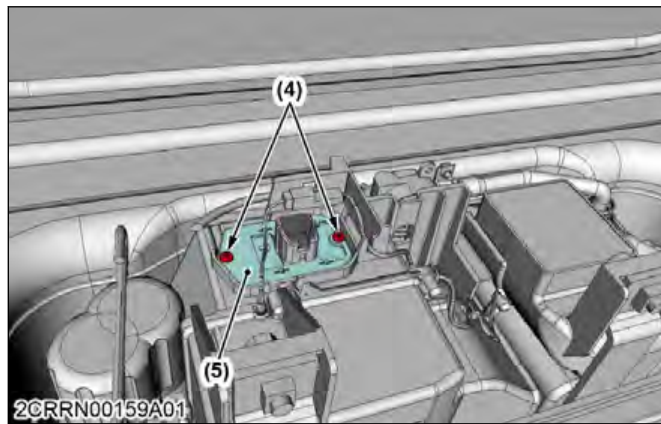
(1) Screw ×8 (2) Cover

3. Disconnect the blower resistor connector.



(3) Blower resistor connector

4. Remove the 2 screws and blower resistor.



(4) Screw ×2 (5) Blower resistor

4.2.1.5 Removing and installing the expansion valve



CAUTION

- Wear gloves, work clothing, and eye protector to protect your skin and eyes. The liquid refrigerant may cause the frostbite hazard due to evaporation.

- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

IMPORTANT

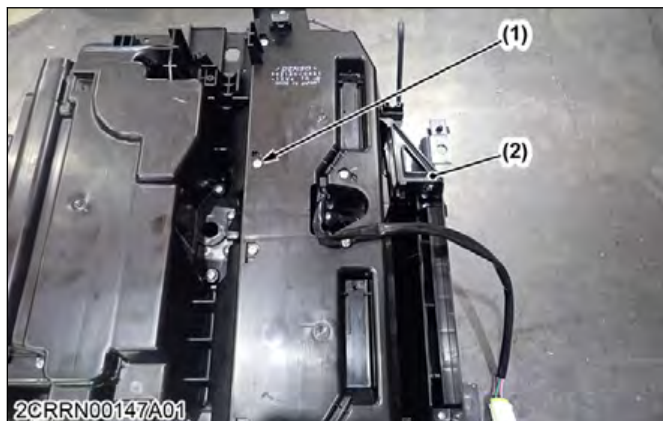
- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using parts which are not specified by R134a may cause leakage, performance decrement, and so on.
- Apply compressor oil to every O-ring to avoid damage when installing.

Preparing

1. Vacuum the refrigerant from the cooling circuit.
2. Remove the air conditioning unit.
3. Remove the heater valve and heater core.

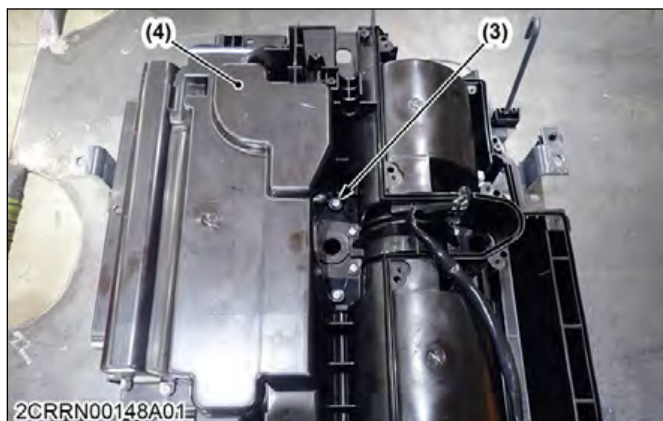
Removing

1. Remove the 13 screws and case.



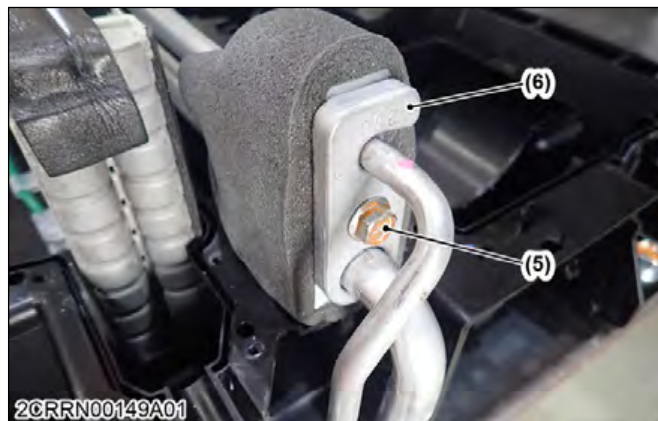
(1) Screw ×13 (2) Case

2. Remove the 20 screws and case.



(3) Screw ×20 (4) Case

3. Remove the bolt and plate.



(5) Bolt (M6 × 20) (6) Plate

4. Remove the 2 cap bolts and expansion valve.



(7) Cap bolt (M5 × 37) ×2 (8) Expansion valve

Installing**IMPORTANT**

- Charge the refrigerant after installing.

Tightening torque

(7) Cap bolt	2.3 to 4.2 N · m 0.24 to 0.42 kgf · m 1.7 to 3.0 lbf · ft	—
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4.2.1.6 Removing and installing the heater valve**CAUTION**

- Keep fire and flammable items away from the working area.

IMPORTANT

- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.

Preparing

1. Vacuum the refrigerant from the cooling circuit.
2. Remove the air conditioning unit.
3. Remove the heater core.

Removing

1. Remove the 2 screws and disconnect the heater pipes from the heater valve.



- (1) Screw ×2
(2) Heater pipe ×2
(3) Heater valve

Installing

■ IMPORTANT

- Replenish the coolant into the engine after installing.

Tightening torque

(1) Screw	1.3 to 1.5 N · m 0.14 to 0.15 kgf · m 0.96 to 1.1 lbf · ft	—
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4.3 Condenser

4.3.1 Removing and installing the condenser

⚠ CAUTION

- Wear gloves, work clothing, and eye protector to protect your skin and eyes. The liquid refrigerant may cause frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

■ IMPORTANT

- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.

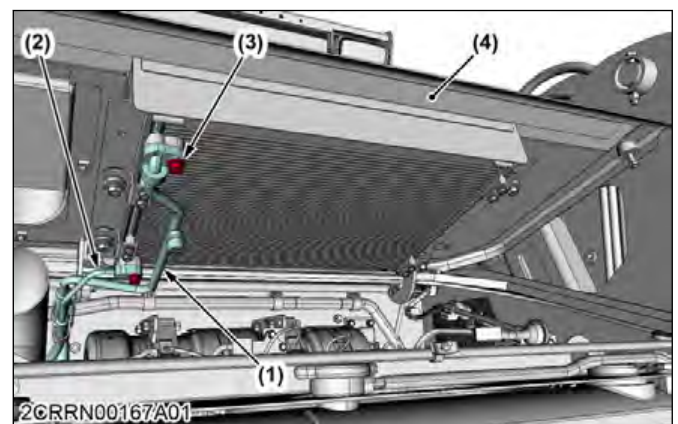
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using parts which are not specified by R134a may cause leakage, performance decrement, and so on.
- Apply compressor oil to every O-ring to avoid damage when installing.

Preparing

1. Open the rear bonnet and insert the pin into the lock position.
2. Vacuum the refrigerant from the cooling circuit.

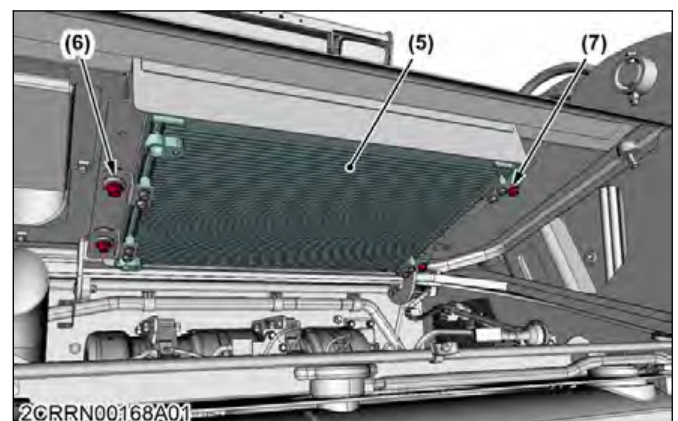
Removing

1. Open the upper bonnet.
2. Remove the 2 bolts, and disconnect the discharge hose and liquid hose from the condenser.



- (1) Discharge hose
(2) Liquid hose
(3) Bolt (M6 × 25) ×2
(4) Upper Bonnet

3. Remove the 2 bolts on each side of the condenser.
4. Remove the condenser mount at 4 points on the condenser support.



- (5) Condenser
(6) Condenser mount
(7) Bolt (M8 × 35) ×4

5. Remove the condenser.

Installing

■ IMPORTANT

- Charge the refrigerant after installing.

Tightening torque

(3) Bolt	3.9 to 6.9 N · m 0.4 to 0.7 kgf · m 2.9 to 5.1 lbf · ft	—
(7) Bolt	10.0 to 12.5 N · m 1.0 to 1.3 kgf · m 7.4 to 9.2 lbf · ft	—

4.4 Receiver**4.4.1 Removing and installing the receiver****CAUTION**

- Wear gloves, work clothing, and eye protector to protect your skin and eyes. The liquid refrigerant may cause frostbite hazard due to evaporation.
- Keep fire and flammable items away from the working area.
- Do not wash the cooling circuit with water. The residual water in the cooling circuit may cause corrosion.

IMPORTANT

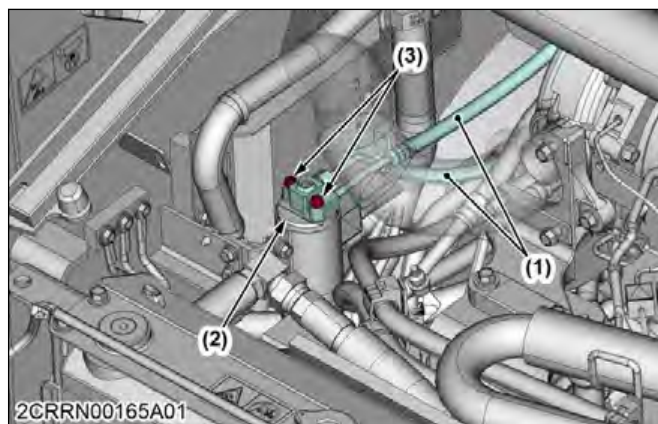
- Work at the clean and dry work space with clean and dry tools.
- Install plugs to the disconnected hoses, pipes, and devices to avoid infiltration of the water and dust contamination.
- Use the refrigerant and parts specified by R134a. Mixing with other refrigerants or using parts which are not specified by R134a may cause leakage, performance decrement, and so on.
- Apply compressor oil to every O-ring to avoid damage when installing.
- Do not remove the plugs on the new receiver just before installing. The dryer in the receiver absorbs moisture in the atmosphere if unplugged.

Preparing

1. Open the rear bonnet and insert the pin into the lock position.
2. Vacuum the refrigerant from the cooling circuit.

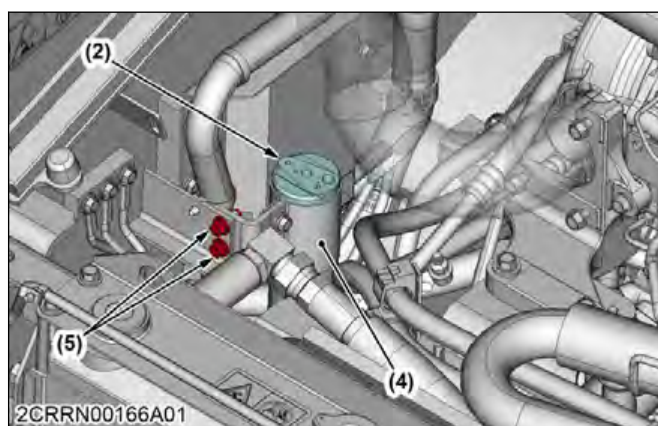
Removing

1. Open the upper bonnet.
2. Remove the 2 bolts and disconnect the liquid hoses from the receiver.



- (1) Liquid hose
(2) Receiver
(3) Bolt (M6 × 25) × 2

3. Remove the 2 bolts, receiver holder, and receiver.



- (2) Receiver
(4) Receiver holder
(5) Bolt (M8 × 25)

Installing**IMPORTANT**

- Charge the refrigerant after installing.

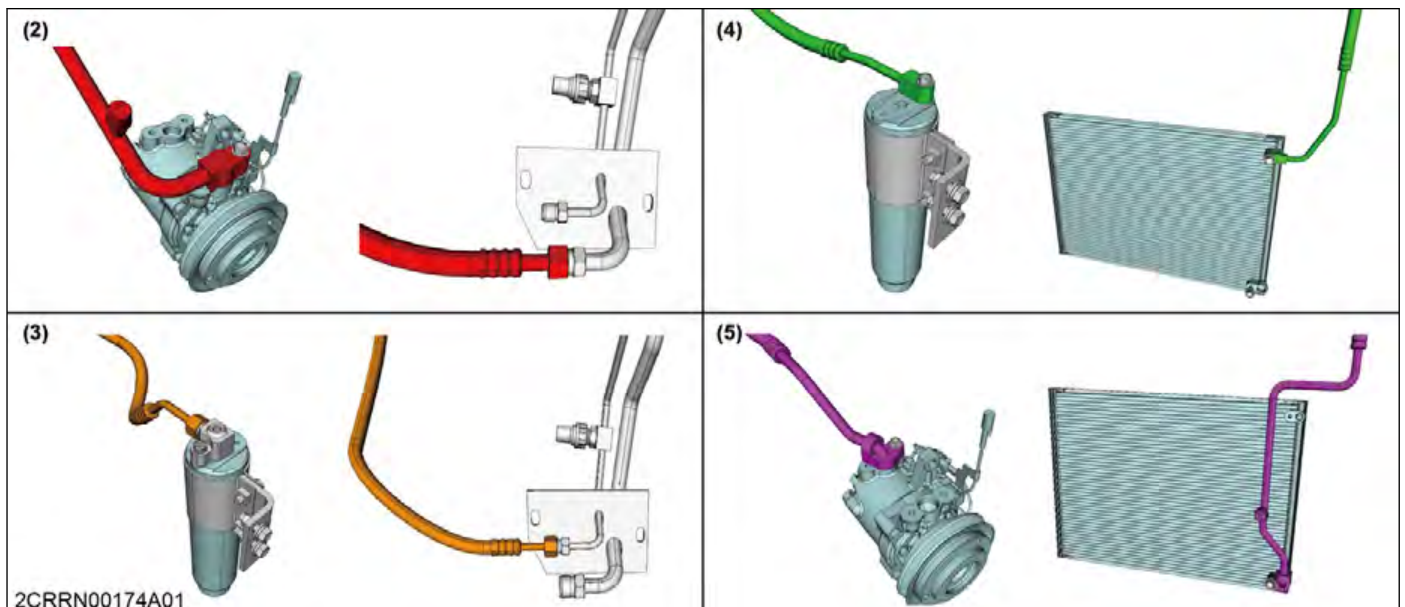
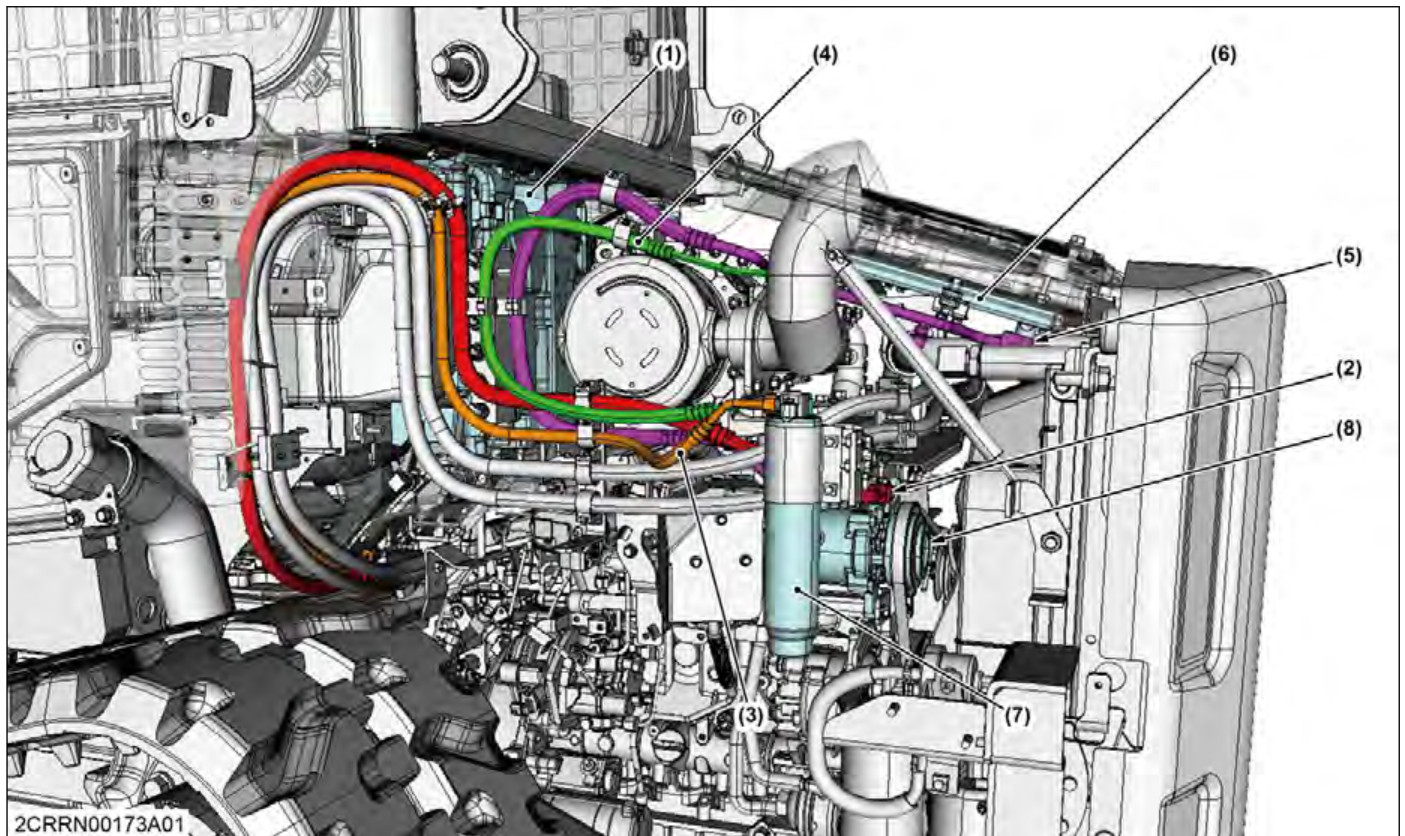
Tightening torque

(3) Bolt	3.9 to 6.9 N · m 0.4 to 0.7 kgf · m 2.9 to 5.1 lbf · ft	—
----------	---	---

4.5 Air conditioning and heater hoses

4.5.1 Air conditioning and heater hose routing

Air conditioning hose



(1) Air conditioning unit
(2) Suction hose

(3) Pressure hose
(4) Liquid hose

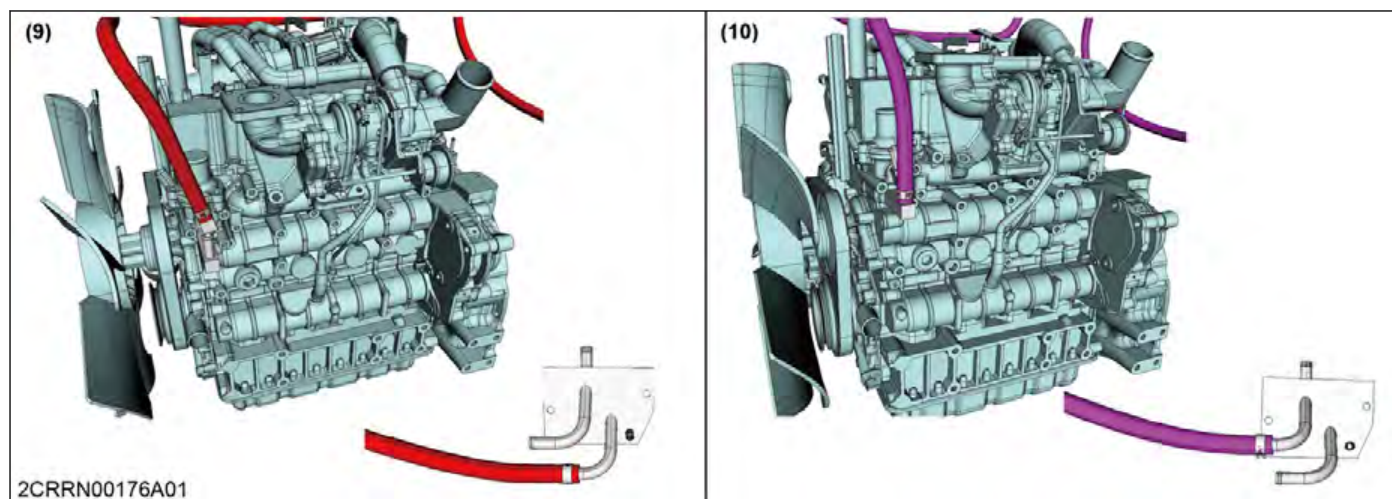
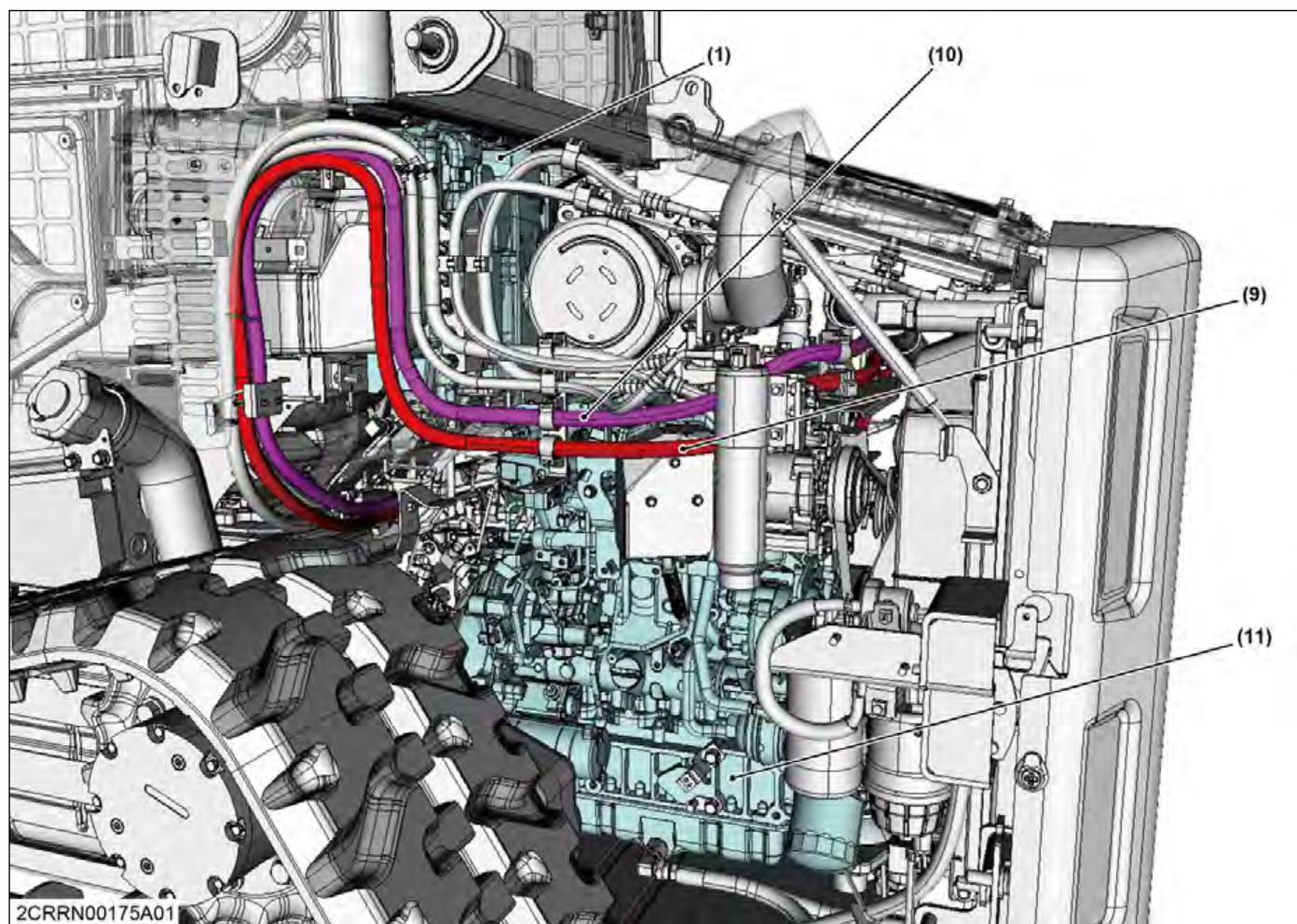
(5) Discharge hose
(6) Condenser

(7) Receiver
(8) Compressor

No.	Point of use	Hose	Protection tube
		Length	Length
(2)	Compressor - Air conditioning unit (outlet)	1725 mm 67.9 in.	1444 mm 56.9 in.
(3)	Receiver - Air conditioning unit (inlet)	1642.4 mm 64.7 in.	1444 mm 56.9 in.
(4)	Receiver - Condenser	720 mm 28.4 in.	590 mm 23.2 in.
(5)	Compressor - Condenser	1215 mm 47.8 in.	680 mm 26.8 in.

Heater hose**■ IMPORTANT**

- Do not kink the heater hoses.
- Do not make the heater hoses contact the exhaust manifold.
- Firmly insert the heater hoses.



(1) Air conditioning unit (9) Heater hose (inlet) (10) Heater hose (outlet) (11) Engine

No.	Point of use	Inner diameter
(9)	Engine - Air conditioning unit (inlet)	φ13 mm φ0.51 in.
(10)	Engine - Air conditioning unit (outlet)	φ13 mm φ0.51 in.

9. APPENDICES

APPENDICES

1. Servicing information

1.1 Service specifications for machine body

■ NOTE

- Standard measurement condition is as follows:
 - Temperature of hydraulic oil and devices: 50 °C (Including motor, pump, and cylinders)
 - Engine speed: Maximum

				Units	Service specifications		Service limits
					Value	Tolerance	Value
Wear	Pin			—	—	—	1 mm of wear on the pin outer diameter
	Bushing			—	—	—	1 mm of wear on the bushing inner diameter
Force	Pilot control lever	Lift arm	Raising	N kgf lbf	20.0 2.05 4.50	±5.0 ±0.45 ±1.1	—
			Lowering	N kgf lbf	21.0 2.15 4.70	±5.0 ±0.45 ±1.1	—
		Bucket	Crowding	N kgf lbf	17.0 1.75 3.80	±5.0 ±0.45 ±1.1	—
			Dumping	N kgf lbf	16.0 1.65 3.60	±5.0 ±0.45 ±1.1	—
	Travel control lever		Forward	N kgf lbf	16.0 1.65 3.60	±5.0 ±0.45 ±1.1	—
			Backward	N kgf lbf	19.0 1.95 4.25	±5.0 ±0.45 ±1.05	—
			Right turn	N kgf lbf	15.0 1.55 3.35	±5.0 ±0.45 ±1.05	—
			Left turn	N kgf lbf	15.0 1.55 3.35	±5.0 ±0.45 ±1.05	—
	Accelerator pedal			N kgf lbf	50.0 5.10 11.0	±10 ±1.0 ±2.0	—
	Dimension	Rubber track	Lug height		mm in.	27.5 1.1	—

(Continued)

				Units	Service specifications		Service limits
					Value	Tolerance	Value
Dimension	Rubber track	Link height		mm in.	48 1.89	—	—
		Width	Normal	mm in.	320 12.6	—	—
			Wide	mm in.	380 15.0	—	—
		Height		mm in.	111 4.4	—	—
		Tension dimension		mm in.	25 1.0	±5 ±0.2	—
	Front idler	Outer diameter		mm in.	φ356 φ14.0	—	φ348 φ13.7
		Guide width		mm in.	96 3.8	—	104 4.1
		Idler width		mm in.	204 8.0	—	—
	Rear idler	Outer diameter		mm in.	φ330 φ13.0	—	φ320 φ12.6
		Guide width		mm in.	59 2.3	—	49 1.9
		Idler width		mm in.	145 5.7	—	—
	Sprocket	Outer diameter		mm in.	φ429 φ16.9	—	φ417 φ16.4
		Inner diameter		mm in.	φ192 φ7.6	—	—
		Sprocket width		mm in.	46 1.8	—	34 1.3
		Gear height		mm in.	118.5 4.7	—	112.5 4.4
	Track roller	Outer diameter		mm in.	φ200 φ7.87	—	φ192 φ7.90
		Track roller width		mm in.	212 8.35	—	—
		Guide width 1		mm in.	88 3.46	—	96 3.8
		Guide width 2		mm in.	30 1.20	—	—

1.2 Service specifications for the engine

			Units	Service specifications		Service limits
				Value	Tolerance	Value
Pressure	Compression pressure		MPa kgf/cm ² psi	3.20 32.6 464	—	2.00 20.4 290
	Engine oil pressure	MAX speed	kPa kgf/cm ² psi	345 3.5 50	±95 ±1.0 ±14	150 1.5 21

1.3 Service specifications for hydraulic system

■ NOTE

- Standard measurement condition is as follows:
 - Hydraulic oil and devices temperature: 50 °C (including motor, pump, and cylinders)
 - Engine speed: Maximum
 - Hydraulic cylinder speed does not include cushioning.

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Flow rate	HST pump		L/min U.S.gals/min	72.0 19.0	—	57.6 15.2
	Main pump		L/min U.S.gals/min	69.8 18.4	—	55.8 14.7
	High-flow pump		L/min U.S.gals/min	38.5 10.2	—	30.8 8.2
	Charge pump		L/min U.S.gals/min	32.7 8.6	—	26.2 6.9
	AUX port	Normal flow	L/min U.S.gals/min	70.0 18.5	—	56.0 14.8
		High-flow	L/min U.S.gals/min	106.5 28.1	—	85.2 22.5
Pressure	Main relief valve	Main pump (aP1)	MPa kgf/cm ² psi	22.4 228 3250	—	—
		High-flow pump (aP2)	MPa kgf/cm ² psi	20.3 207 2940	—	—
		Charge pump (aPP)	MPa kgf/cm ² psi	4.6 47 670	—	—
		High pressure relief valve (HST motor LH forward movement) (aLF)	MPa kgf/cm ² psi	37.5 382 5440	±1.5 ±15 ±220	—

(Continued)

			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Pressure	Main relief valve	High pressure relief valve (HST motor LH backward movement) (aLB)	MPa kgf/cm ² psi	37.5 382 5440	±1.5 ±15 ±220	—
		High pressure relief valve (HST motor RH forward movement) (aRF)	MPa kgf/cm ² psi	37.5 382 5440	±1.5 ±15 ±220	—
		High pressure relief valve (HST motor RH backward movement) (aRB)	MPa kgf/cm ² psi	37.5 382 5440	±1.5 ±15 ±220	—
	Overload relief valve	Lift arm cylinder bottom (b1B)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		Lift arm cylinder rod (b1R)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		Bucket cylinder bottom (b2B)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		Bucket cylinder rod (b2R)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		AUX port male (b3M)	MPa kgf/cm ² psi	25.0 255 3630	—	—
		AUX port female (b3F)	MPa kgf/cm ² psi	25.0 255 3630	—	—
	Pilot pressure	Charge relief valve (pCR)	MPa kgf/cm ² psi	3.7 38 540	—	—
		Unload relief valve (pUR)	MPa kgf/cm ² psi	3.9 40 570	—	—
	Pilot primary pressure	Front attachment control valve	MPa kgf/cm ² psi	3.8 39 550	—	—
		Travel control valve	MPa kgf/cm ² psi	2.6 27 380	—	—
	Pilot secondary pressure	Front attachment control valve	MPa kgf/cm ² psi	3.5 36 510	—	—
		Travel control valve	MPa kgf/cm ² psi	2.1 21 300	—	—

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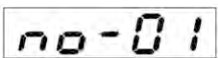
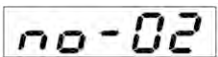
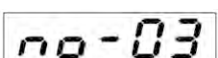
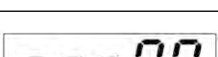
			Unit	Service specifications		Service limits
				Value	Tolerance	Value
Internal leakage	Lift arm cylinder		mm in.	Less than 27 Less than 1.1	—	105 5.5
	Bucket cylinder		mm in.	Less than 20 Less than 0.8	—	100 4.0
	HST motor	When the machine is facing up the slope	mm in.	0 0	—	—
		When the machine is facing down the slope	mm in.	0 0	—	—
Speed	Lift arm cylinder	Raising	s	4.0	±0.2	—
		Lowering	s	2.5	±0.2	—
	Bucket cylinder	Crowding	s	1.6	±0.2	—
		Dumping	s	2.1	±0.2	—
	Traveling	Low speed	s/20 m	9.2	±0.9	—
		High speed	s/20 m	6.3	±0.6	—
Others	Travel straightness *1	Low speed	rpm	2.5	—	—
		High speed	rpm	5.5	—	—
	Self-leveling angle *2	At the highest position	degree	—	-2 to +6	—

*1: The difference of the rotation number between the HST motor LH and RH.

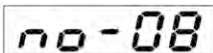
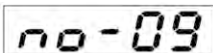
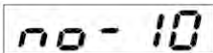
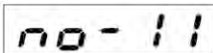
*2: "+" indicates that the front attachment inclines to the crowding side, and "-" indicates that the front attachment inclines to the dumping side, when viewed from the side.

1.4 Service dealer mode

1.4.1 Service dealer mode list

Mode	Detail	
	Tester mode	Displays the machine information, and status of sensors and solenoids.
	AUX knob switch setting	Sets the left and right ends and neutral position for the AUX knob switch. • Required setting after replacing the AUX knob switch.
	AUX start-up point setting	Sets the start-up point of the AUX with attachment. • Required setting after replacing an attachment or cylinder. • Required setting after repairing hydraulic devices.
	AUX fine setting	Fine setting for the start-up point of the actuator (cylinder) attached to the AUX.
	HST start-up point settings	Sets the start-up point of the forward and backward travel. • Required setting after replacing the HST pump, travel control valve, or anti-stall proportional solenoid.
	Accelerator pedal and dial setting	Sets the maximum and minimum position for the accelerator pedal and dial. • Required setting after replacing the accelerator pedal, accelerator dial, or potentiometer.

(Continued)

Mode		Detail
	Model setting	Sets the model, AUX flow (normal flow or high-flow) and accelerator specification (accelerator dial or accelerator lever).
	Reading error history	Displays the previous error code and hour meter from the main ECU.
	Clearing error history	Clears error history of "no-09".
	Reading all error history	Displays the previous error code and hour meter from the main ECU. Unable to clear in "no-10" (clearing error history).

1.4.2 Tester mode list

No.		Display	Description
1	Engine speed	"0000" rpm	Present engine speed
2	Battery voltage	"00.0" V	- Engine stopped: approximately 12.0 V - Engine running: approximately 14.0 V
3	Engine oil pressure switch	"ON" or "OFF"	- Engine stopped: "ON" - Engine running: "OFF"
4	Battery charge switch	"ON" or "OFF"	- Engine stopped: "ON" - Engine running: "OFF"
5	Starter switch	"ON" or "OFF"	- Starter switch [START]: "ON" - Starter switch [RUN] or [STOP]: "OFF"
6	Work light switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
7	Coolant temperature	"000.0" °C	More than 120 °C (248 °F): engine overheating warning
8	Hydraulic oil temperature	"000.0" °C	- More than 103 °C (217 °F): hydraulic oil overheating warning - Less than -50 °C (-58 °F), more than 150 °C (302 °F): hydraulic oil temperature sensor error
9	Accelerator pedal output voltage (main)	"0.00" V	Present main output voltage
10	Accelerator pedal output voltage (sub)	"0.00" V	Present sub output voltage
11	Accelerator dial output voltage (main)	"0.00" V	Present main output voltage
12	Accelerator dial output voltage (sub)	"0.00" V	Present sub output voltage
13	Accelerator pedal minimum output voltage (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-07": accelerator pedal and dial setting)
14	Accelerator pedal maximum output voltage (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-07": accelerator pedal and dial setting)
15	Accelerator dial minimum output voltage (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-07": accelerator pedal and dial setting)
16	Accelerator dial maximum output voltage (main)	"ON" or "OFF"	Value which is adjusted in the service dealer mode ("no-07": accelerator pedal and dial setting)
17	Fuel level sensor (voltage)	"0.00" V	Present voltage of the fuel level sensor.

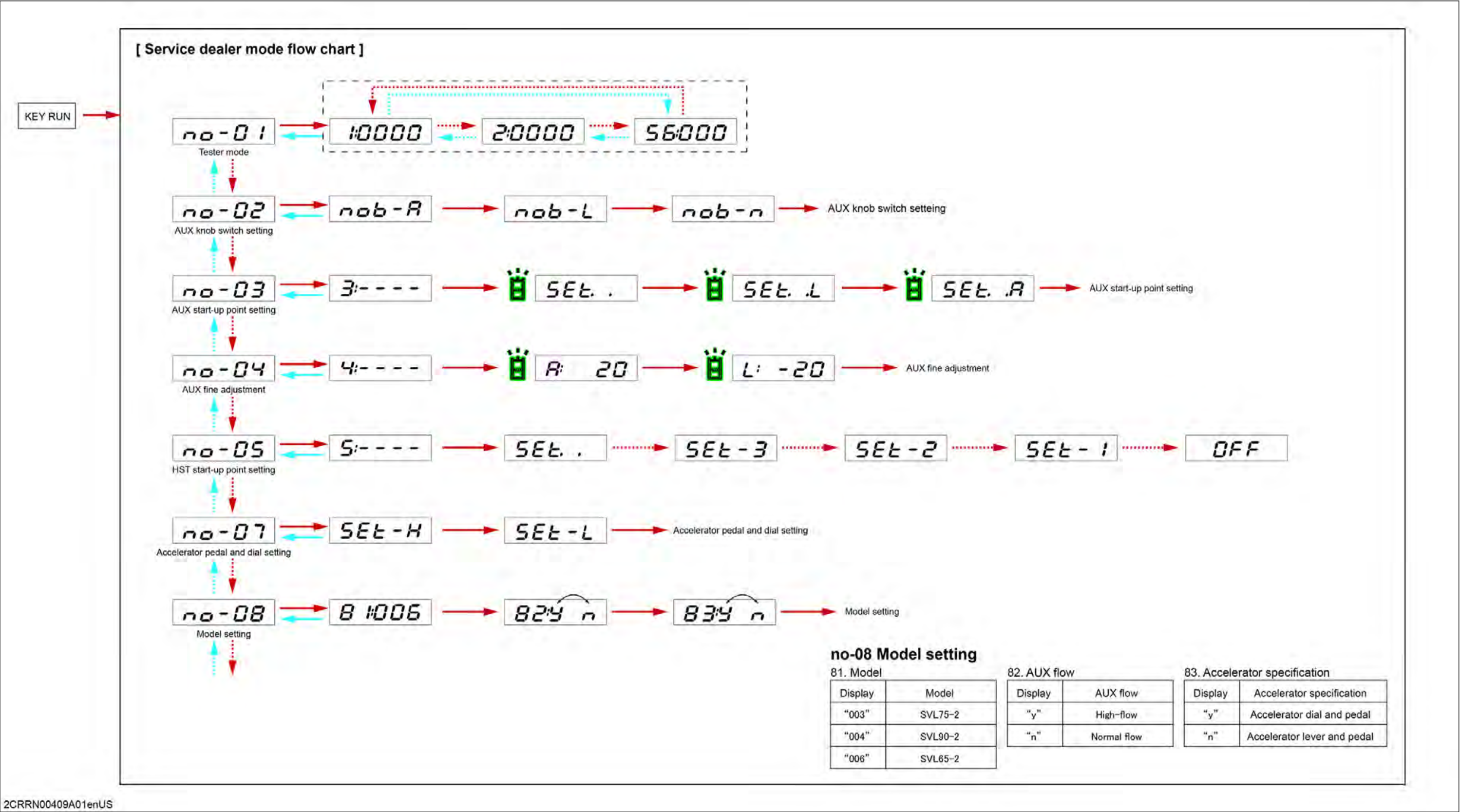
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No.		Display	Description
18	Fuel level sensor (resistance)	"∞" Ω	More than 135 Ω: fuel level sensor error
19	Water separator full water switch	"ON" or "OFF"	- Water separator is full with water: "ON" - Water separator is not full with water: "OFF"
20	Travel speed shift switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
21	Travel speed shift solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
22	Hydraulic unlock switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
23	Hydraulic unlock solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
24	AUX switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
25	AUX relay	"ON" or "OFF"	- AUX is activated: "ON" - AUX is deactivated: "OFF"
26	High-flow switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
27	High-flow solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
28	Armrest switch RH	"ON" or "OFF"	- Armrest RH is lowered: "ON" - Armrest RH is raised: "OFF"
29	Armrest switch LH	"ON" or "OFF"	- Armrest LH is lowered: "ON" - Armrest LH is raised: "OFF"
30	Parking brake switch	"ON" or "OFF"	- Switch pressed: "OFF" - Switch released: "ON"
31	Parking brake solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
32	Float switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
33	Float solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
34	Lift arm pressure switch (raising)	"ON" or "OFF"	- Lift arm raising pilot pressure is not detected: "ON" - Lift arm raising pilot pressure is detected: "OFF"
35	Lift arm pressure switch (lowering)	"ON" or "OFF"	- Lift arm lowering pilot pressure is detected: "ON" - Lift arm lowering pilot pressure is not detected: "OFF"
36	Setting connector	"ON" or "OFF"	- The setting connector is connected: "ON" - The setting connector is disconnected: "OFF"
37	Back-up buzzer pressure switch	"ON" or "OFF"	- Travel backward pilot pressure is detected: "ON" - Travel backward pilot pressure is not detected: "OFF"

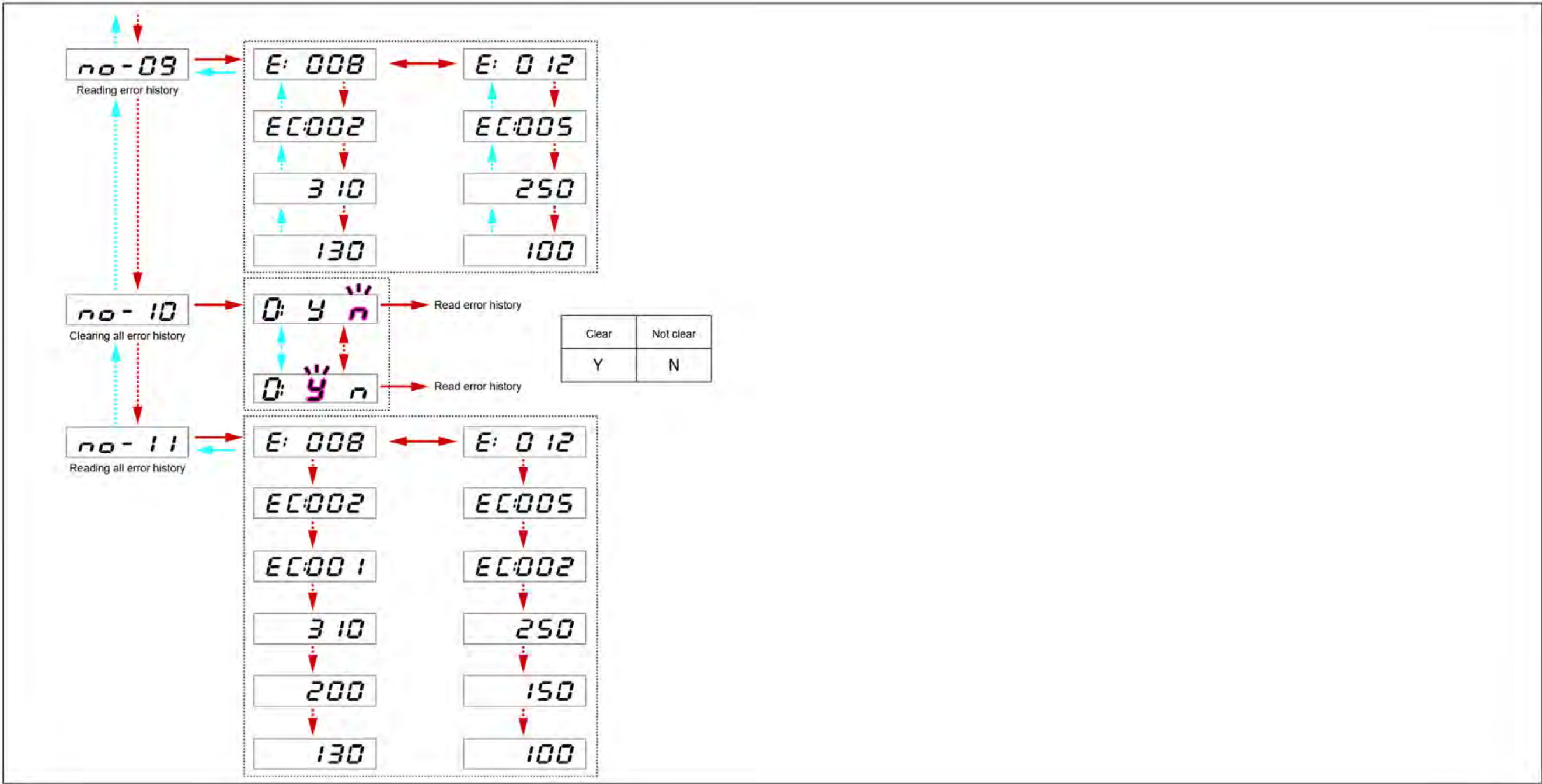
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No.		Display	Description
38	Back-up buzzer output	"ON" or "OFF"	- ECU is sending signal to the back-up buzzer: "ON" - ECU is not sending signal to the back-up buzzer: "OFF"
39	OPC (operator presence control) switch	"ON" or "OFF"	- Operator is on the operator's seat: "ON" - Operator is not on the operator's seat: "OFF"
40	DPF regeneration inhibit switch lamp	"ON" or "OFF"	- The inhibit lamp is lit: "ON" - The inhibit lamp is not lit: "OFF"
41	DPF regeneration inhibit switch	"ON" or "OFF"	- Switch pressed: "ON" - Switch released: "OFF"
42	DPF manual regeneration switch	"ON" or "OFF"	- DPF is regenerated manually: "ON" - DPF is not regenerated manually: "OFF"
43	AUX knob switch output voltage (main)	"0.00" V	Present main output voltage
44	AUX knob switch sub output voltage (sub)	"0.00" V	Present sub output voltage
45	AUX knob switch output voltage at LH end (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-02": AUX knob switch setting)
46	AUX knob switch output voltage at neutral position (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-02": AUX knob switch setting)
47	AUX knob switch output voltage at RH end (main)	"0.00" V	Value which is adjusted in the service dealer mode ("no-02": AUX knob switch setting)
48	AUX current	"0.0" A	Current applied on the AUX proportional valve
49	AUX LH current start-up setting value	"0.0" A	Value which is adjusted in the service dealer mode ("no-03": AUX start-up point setting)
50	AUX RH current start-up setting value	"0.0" A	Value which is adjusted in the service dealer mode ("no-03": AUX start-up point setting)
51	Hydraulic quick hitch solenoid	"ON" or "OFF"	- ECU is sending signal to the solenoid: "ON" - ECU is not sending signal to the solenoid: "OFF"
52	Anti-stall current	"0.0" A	Current applied on the anti-stall proportional valve
53	Cab relay	"ON" or "OFF"	- Engine is running: "ON" - Engine is not running: "OFF"
54	Buzzer	"ON" or "OFF"	- Buzzer is beeping from the meter panel: "ON" - Buzzer is not beeping from the meter panel: "OFF"
55	Model setting	"3" "6"	The number represents the model setting in the service dealer mode. 3: SVL75-2 6: SVL65-2
56	AUX flow	"ON" or "OFF"	- High-flow is selected in the model setting: "ON" - Normal flow is selected in the model setting: "OFF"

2. Service dealer mode flow chart



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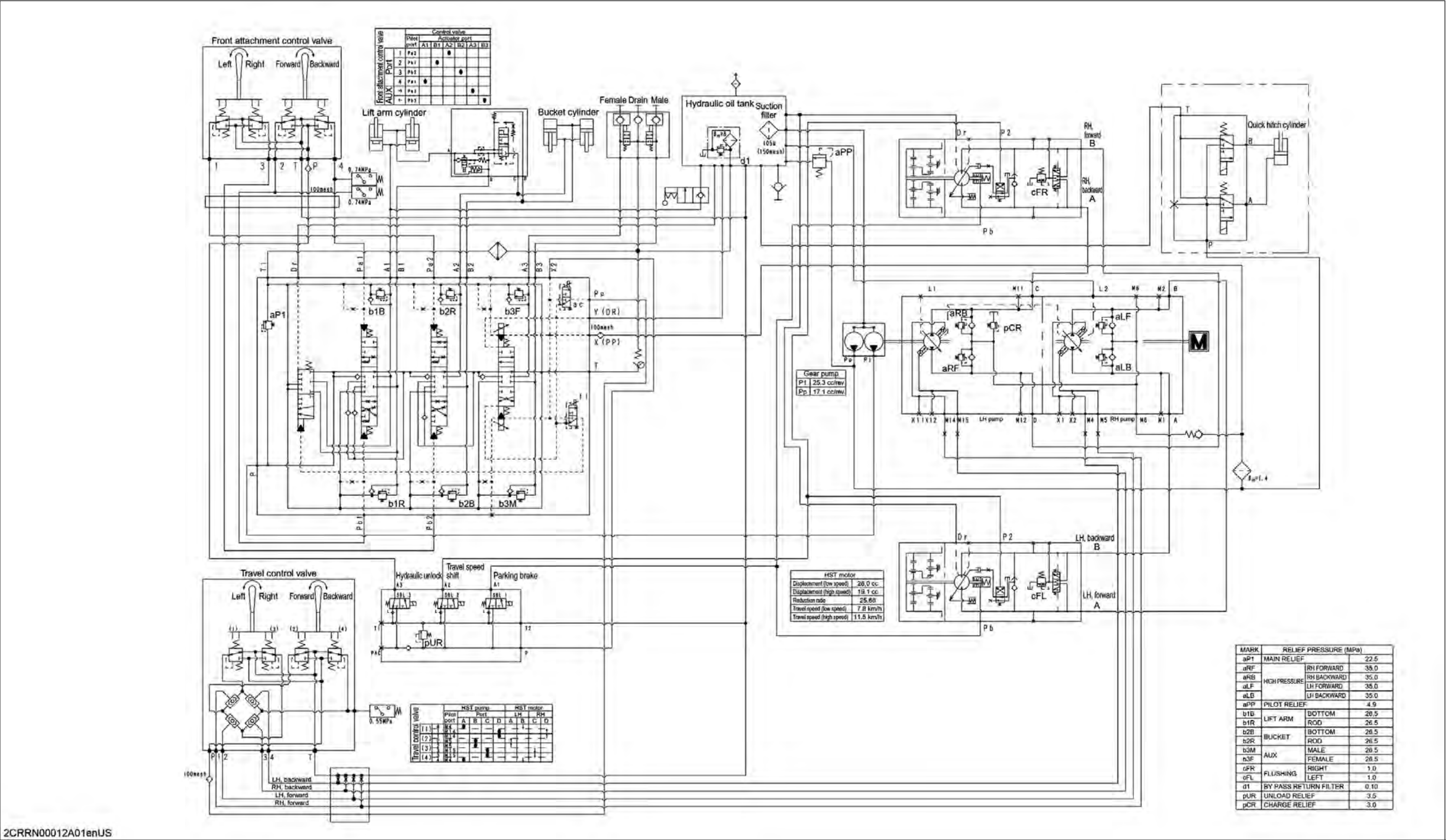


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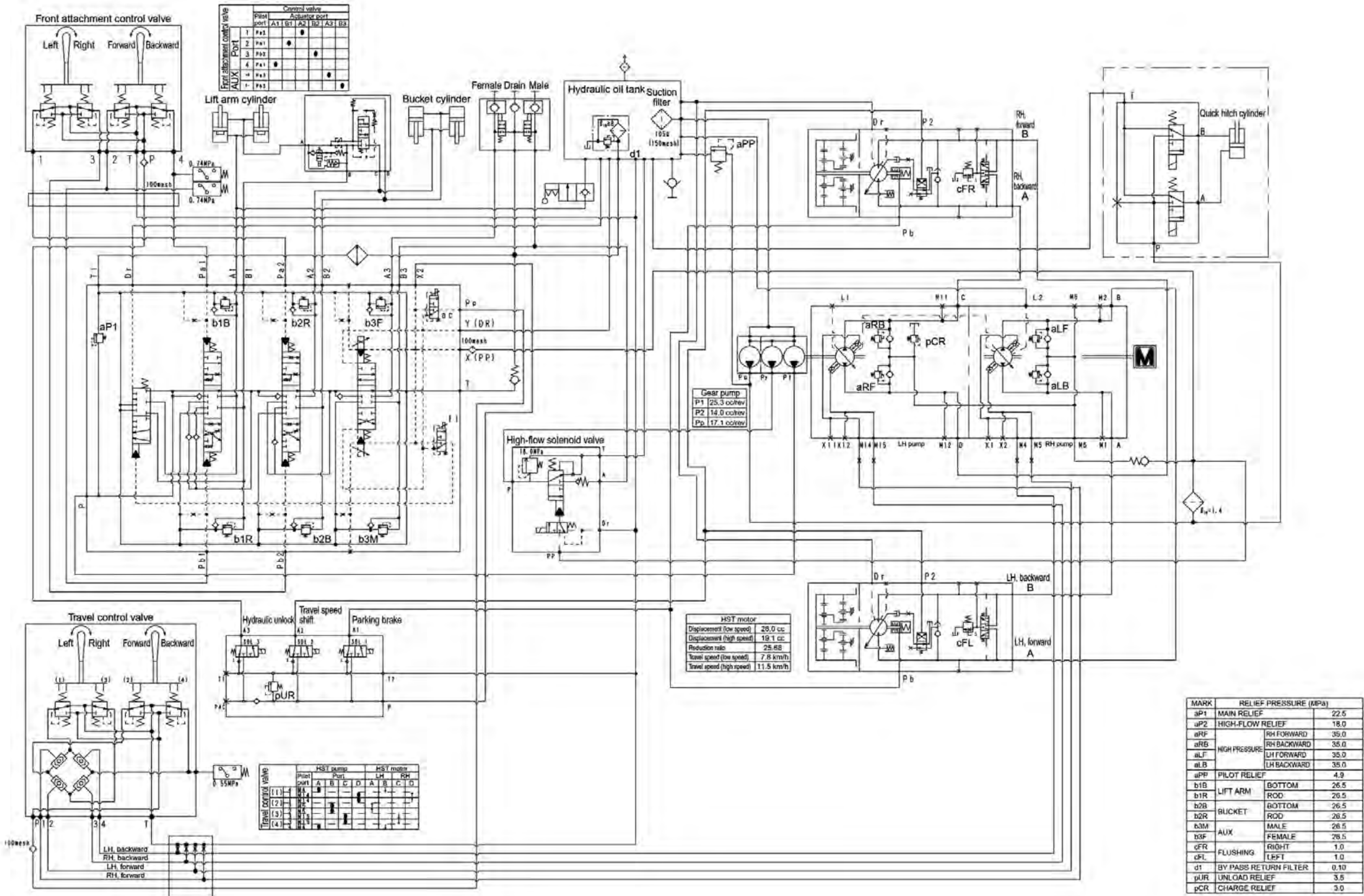
3. Hydraulic circuit diagram

3.1 Hydraulic circuit diagram

Normal flow specification

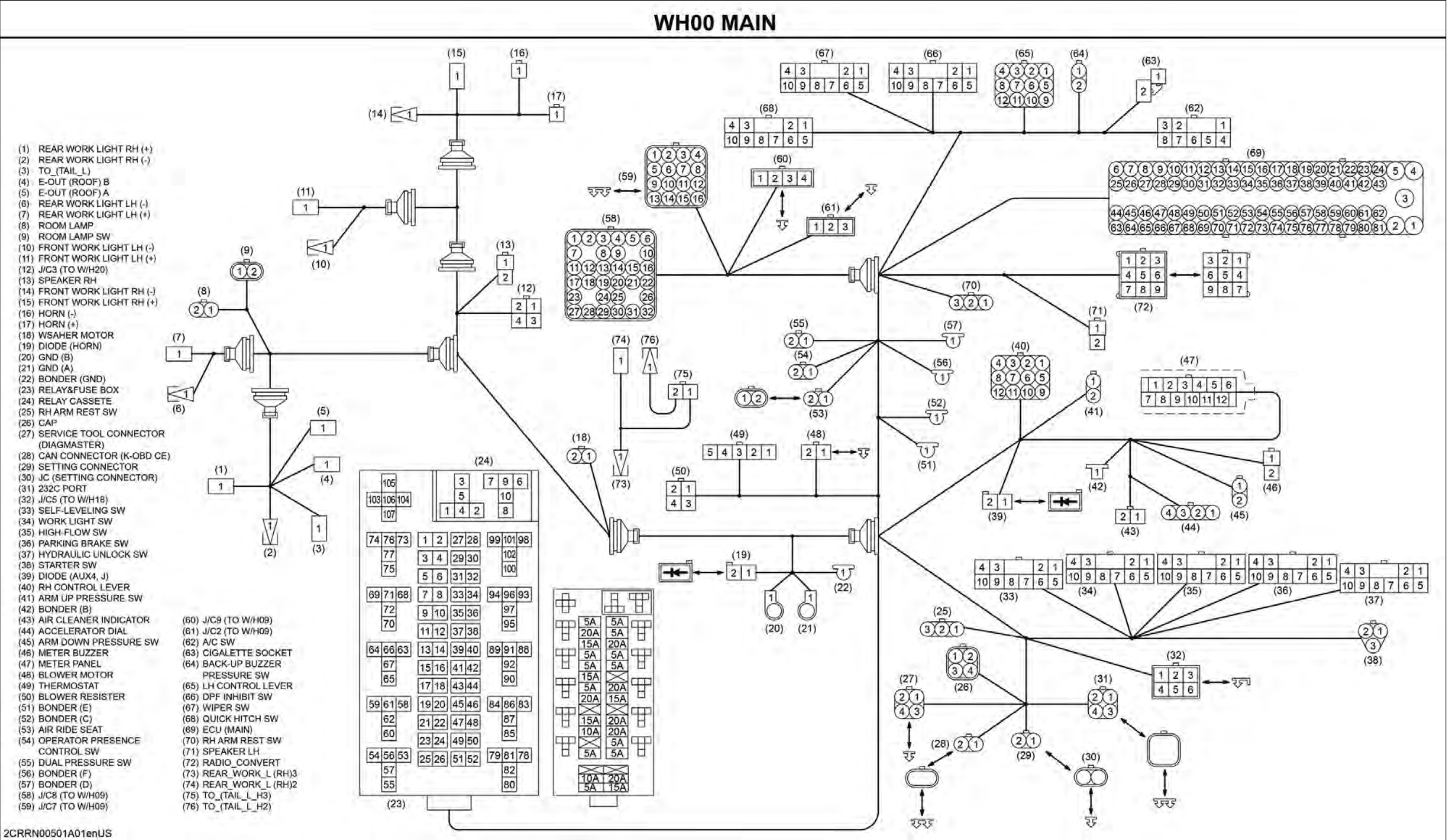


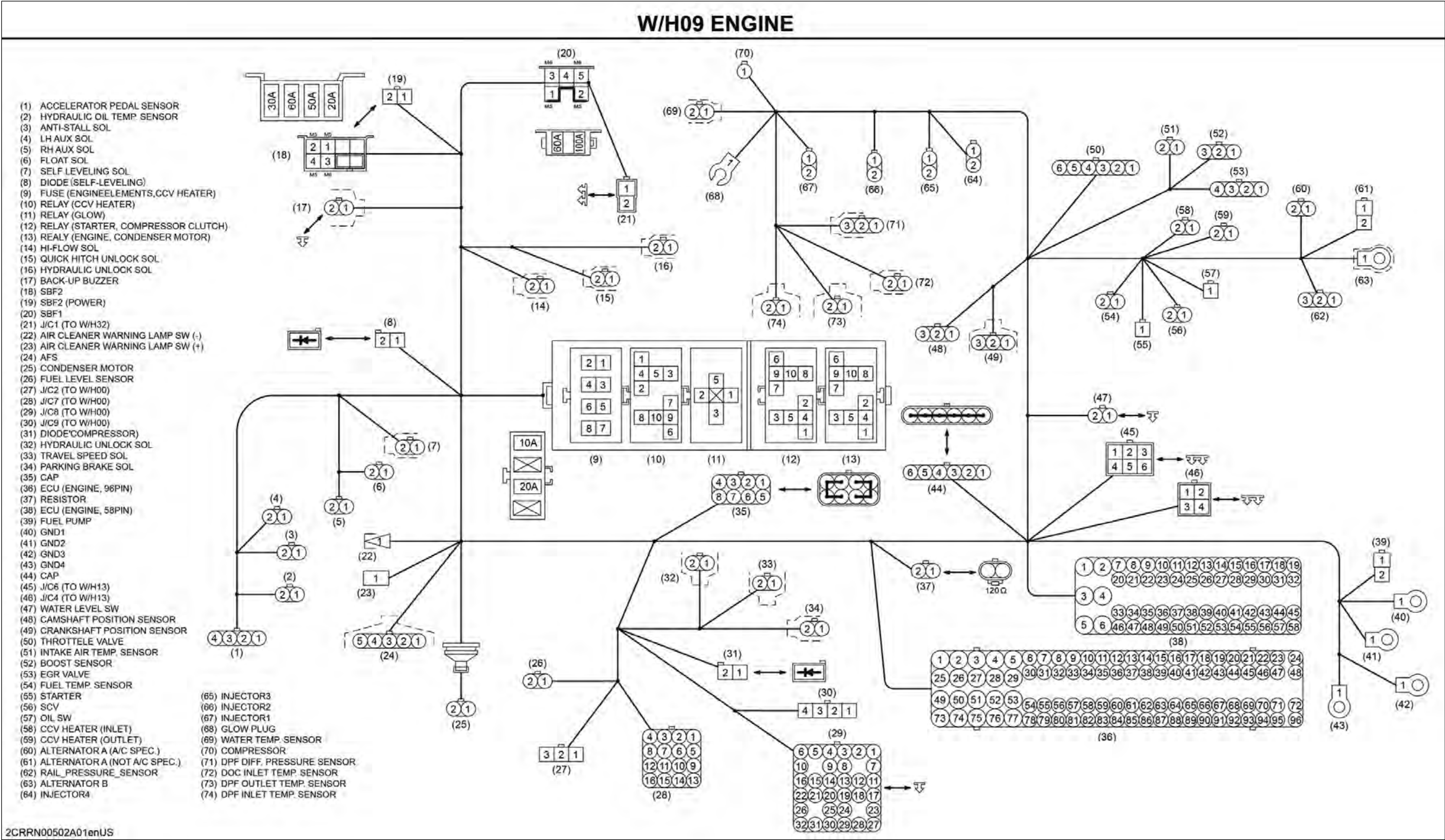
High-flow specification

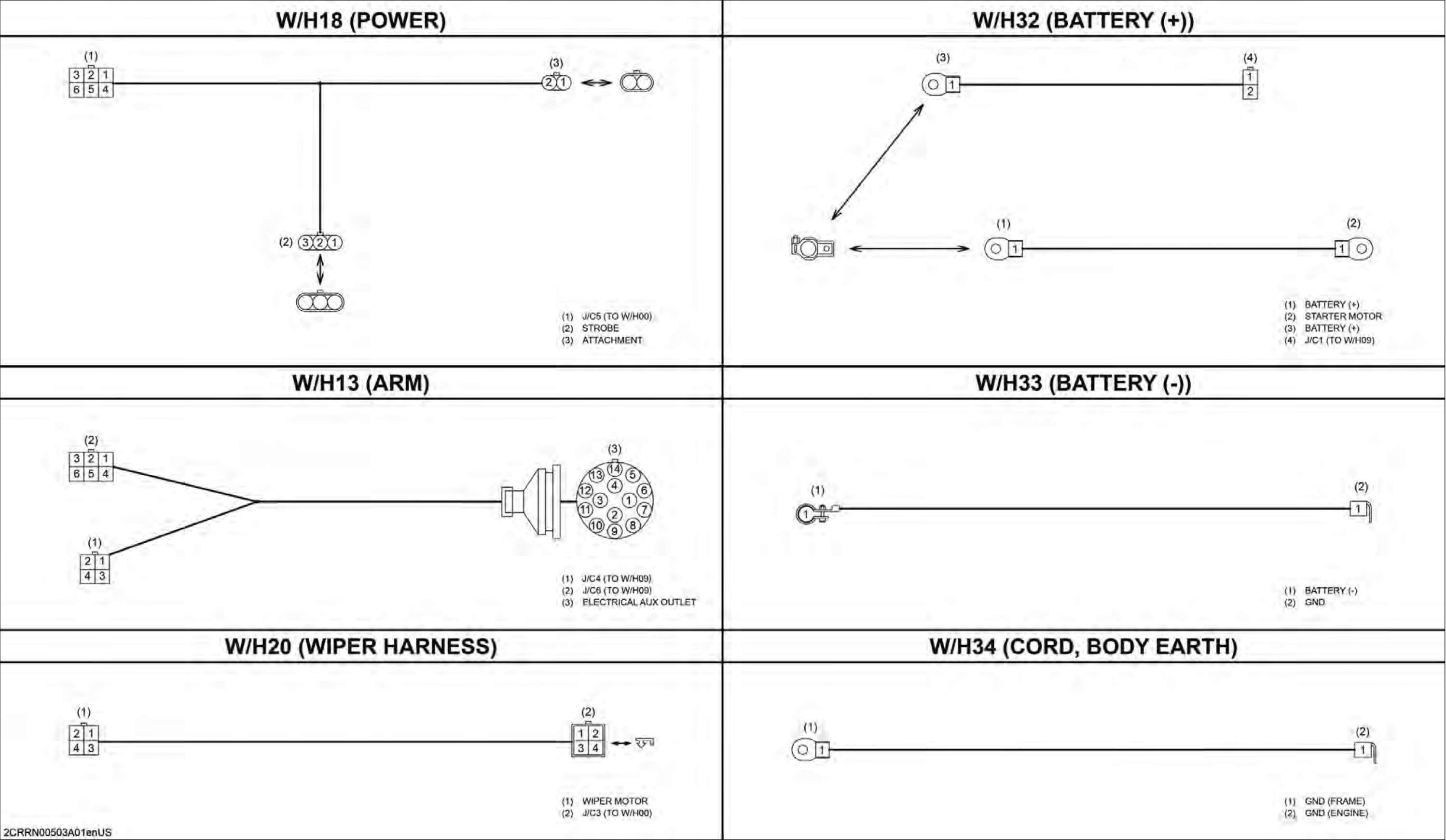


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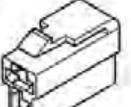
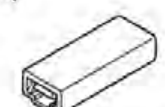
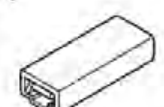
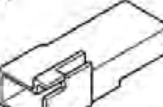
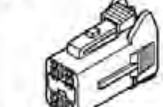
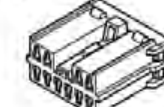
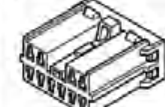
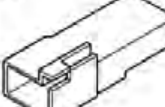
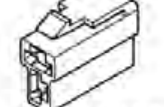
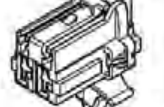
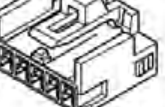
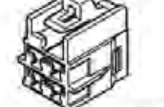
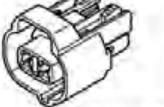
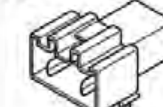
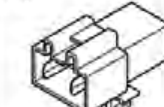
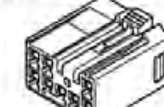
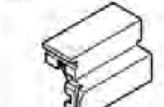
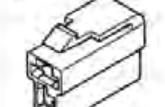
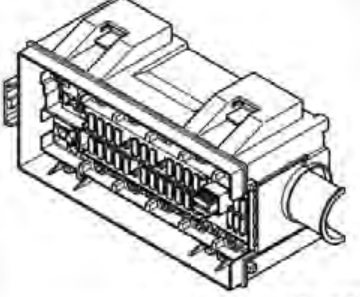
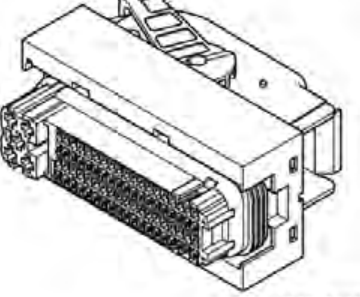
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4.1 Wire harness



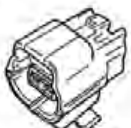
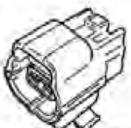
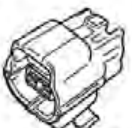
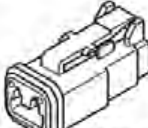
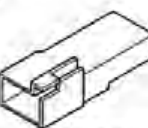
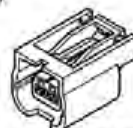
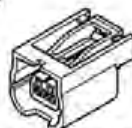
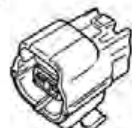
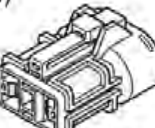
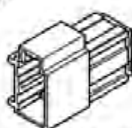
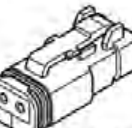
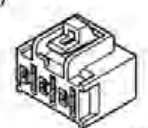
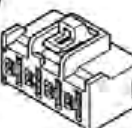
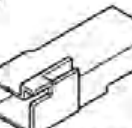
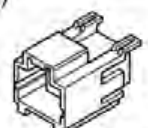
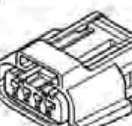
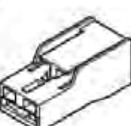
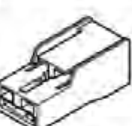
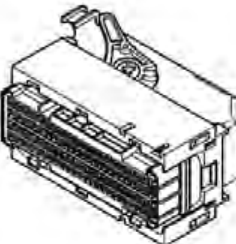
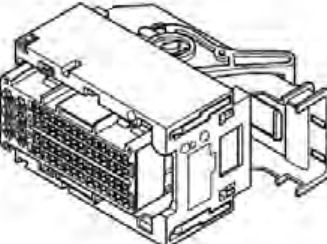
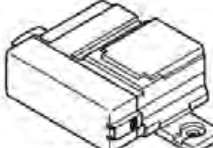
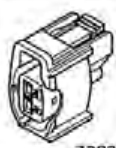
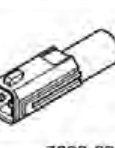
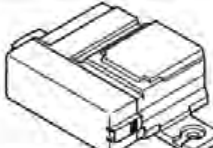
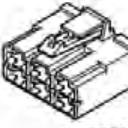
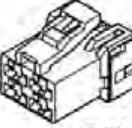
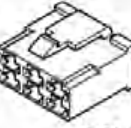
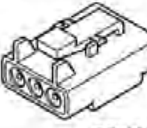
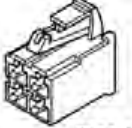




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W/H00 (MAIN)											
(1)  7115-1050-02	(2)  7113-1020-02	(3)  7115-1050-02	(4)  7115-1050-02	(5)  7115-1050-02	(6)  7115-1050-02	(7)  7113-1020-02	(8)  7323-8522-40	(9)  7322-9422	(10)  7115-1050-02	(11)  7113-1020-02	(12)  7323-1640
(13)  7323-2820	(14)  7115-1050-02	(15)  7113-1020-02	(16)  7323-2010	(17)  7323-2010	(18)  7323-9327	(19)  7323-7729-40	(20)  7009-9228-02	(21)  7009-9229-02	(25)  7383-8331-40	(27)  7323-7340-30	(28)  7323-8520-40
(29)  7283-7020-10	(31)  7323-7740-40	(32)  7323-8307	(33)  7323-8307	(34)  7323-8307	(35)  7323-8307	(36)  7323-8307	(37)  7323-8307	(38)  7123-6234-40	(39)  7323-7729	(40)  7323-7923-40	(41)  7383-7222-10
(43)  7115-1050-02	(44)  7383-7449-30	(45)  7383-7222-60	(46)  7323-2820	(47)  7383-8389-40	(48)  7323-5525	(49)  7383-1050	(50)  7383-7047	(53)  7383-7222-60	(54)  7329-1111	(55)  7323-1223-40	(58)  7382 8745-10
(59)  7322-7923-40	(60)  7382-3040	(61)  7382-3030	(62)  7383-1080-80	(63)  7323-8322	(64)  7383-7222-60	(65)  7323-7923-40	(66)  7323-8307	(67)  7323-8307	(68)  7323-8307	(70)  7383-8331-40	(71)  7323-2820
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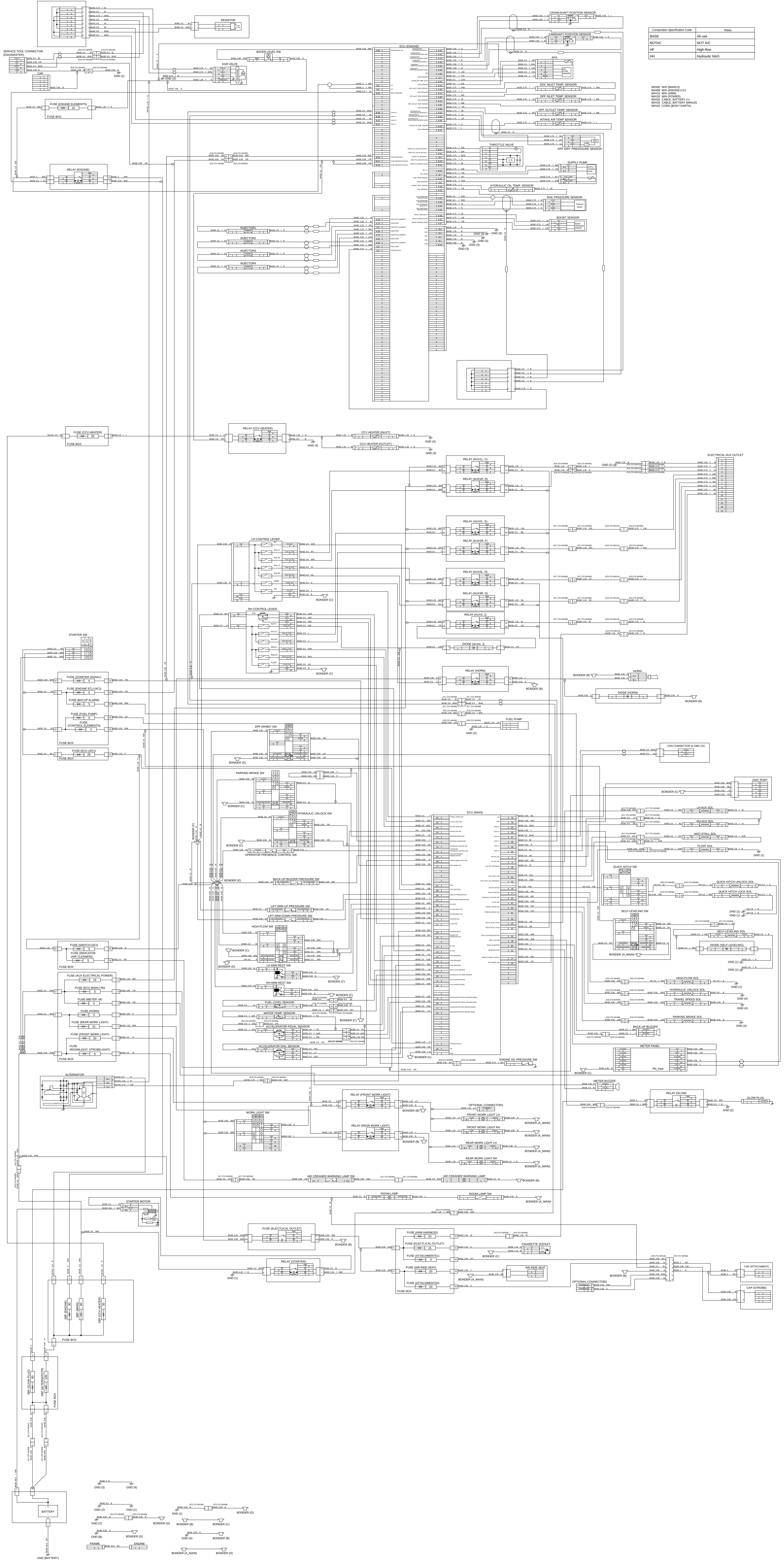
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(19)  7123-4220-30	(21)  7322-4123-30	(22)  7113-1020	(23)  7115-1050	(24)  7383-8355-30	(25)  7329-3393-40	(26)  7323-9423	(27)  7383-3030	(28)  7323-7923-40	(29)  7383-8745-10	(30)  7383-3040	(31)  7323-7729	
(32)  7383-2090-30	(33)  7383-2090-30	(34)  7383-2090-30	(37)  7323-6423-30	(39)  7329-3023	(45)  7322-6080	(46)  7322-6040	(47)  7323-8321-30	(48)  7383-4673-30	(49)  7383-4673-40	(50)  7383-1968-30	(51)  7383-7027-40	
(52)  7383-1032-30	(53)  7383-1740-10	(54)  7383-7020	(55)  7323-2710	(56)  7009-1836	(57)  7323-2710-40	(58)  7383-9184-30	(59)  7383-9184-30	(60)  7323-6224-40	(61)  7383-2090-30	(62)  7387-9921-30	(63)  7009-1352-02	
(36)  7383-2457-30	(38)  7383-2518-30		(18)  7354-5909-30	(64)  7383-5750	(65)  7383-5750	(66)  7383-5750	(67)  7383-5750	(69)  7383-8728-10	(70)  7323-8918-30			
(20)  7354-5909-30			(71)  7387-5800-30	(72)  7383-7026-30	(73)  7383-7023	(74)  7383-7028-10						
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(1)  7323-2865	(2)  7323-6040	(3)  7123-6060	(1)  PTM06-3S	(2)  DTP06-2S-E003	(3)  7323-2845	(1)  7323-2845	(2)  7323-2845					

2CRRN00569A01enUS



WIH00 WIH (MAIN,C)
WIH09 WIH (ENGINE,C)
WIH13 WIH (ARM)
WIH18 WIH (POWER)
WIH20 WIH (WIPER)
WIH32 CABLE, BATTERY (+)
WIH33 CABLE, BATTERY (MINUS)



ELECTRICAL CIRCUIT DIAGRAM (SVL65-2 OPEN CAB)

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Editor : Kubota Corporation Construction Machinery Service Technical Support Dept.
Address : 1-1 Nakamiya-Ohike 1-Chome, Hirakata-City, Osaka, 573-8573, Japan
Phone : +81-72-840-1195
Fax : +81-72-890-2883
E-mail : kbt_g.ce-sv@kubota.com
